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THESIS

ORGANIZATIONAL FITNESS OF A PROPOSED
NETWORK CENTRIC ORGANIZATION

by

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December 1998

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Network Centric Warfare (NCW) has emerged as a new concept for the U.S. Navy. NCW capitalizes on technology to obtain and maintain an enhanced situational awareness and uses the distributed offensive firepower of the collective force to fight the battle. Speed of Command and Self-Synchronization are key tenents of NCW. The author proposes an organization designed to operate in the NCW environment. It consists of the Force Commander and commanders of Situational Awareness, Resources, Effects, and Operations. The research question of this thesis is whether or not the proposed organization is fit in the NCW environment. The organization is looked at in two "snapshots": one is the planning process and the other is the execution process. The expert system Organizational Consultant is used to analyze the organization and determine its organizational fitness. The results indicate that the proposed organization is fit if changes are made to make the planning process highly centralized and the execution process decentralized. Formalization will also need to be lowered in the organization.

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ORGANIZATIONAL FITNESS OF A PROPOSED NETWORK CENTRIC ORGANIZATION

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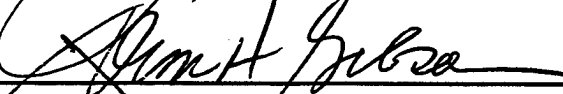## NAVAL POSTGRADUATE SCHOOL
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ABSTRACT

Network Centric Warfare (NCW) has emerged as a new concept for the U.S. Navy. NCW capitalizes on technology to obtain and maintain an enhanced situational awareness and uses the distributed offensive firepower of the collective force to fight the battle. Speed of Command and Self-Synchronization are key tenents of NCW. The author proposes an organization designed to operate in the NCW environment. It consists of the Force Commander and commanders of Situational Awareness, Resources, Effects, and Operations. The research question of this thesis is whether or not the proposed organization is fit in the NCW environment. The organization is looked at in two "snapshots": one is the planning process and the other is the execution process. The expert system Organizational Consultant is used to analyze the organization and determine its organizational fitness. The results indicate that the proposed organization is fit if changes are made to make the planning process highly centralized and the execution process decentralized. Formalization will also need to be lowered in the organization.

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EXECUTIVE SUMMARY

This thesis considers the fitness of a proposed organization for the Navy, designed to operate in a Network Centric Warfare (NCW) environment. The research question answered is: "Is the proposed organizational structure fit in a NCW environment?" The Organizational Consultant expert system is used to analyze the proposed organization.

Several characteristics of a command and control structure and decision processes are important to understand when designing a military organization. These include the roles of an organization, information processing, span of control, the process of command and control (the OODA loop), unity of command, unity of effort, commander's intent, planning, and adaptation.

NCW, whose goal is to terminate conflicts very quickly and not allow wars of attrition to develop, is the Navy's response to information age conflicts. NCW derives its power from the robust networking of a geographically dispersed, but knowledgeable force. NCW is enabled by four interrelated supporting elements: enhanced situational awareness, speed of command, self-synchronization, and offensive distributed firepower.

The proposed NCW organization is no longer centered around commanders of platforms. It is focused on the functions and processes that the force will need to self-synchronized in the NCW environment. Ship commanding officers will be responsible for "manning, training, and equipping" the ships. The Force Commander will promulgate the overall intent while the fighting of the battle will be done by functional commanders: a Chief Knowledge Officer, a Chief Resources Officer, a Chief Effects Officer, and a Chief Operating Officer (Figure ES-1).

Command Relationships →

Force Commander

Chief Knowledge Officer (CKO) | Chief Resources Officer (CRO) | Chief Effects Officer (CEFO) | Chief Operating Officer (COO)

Knowledge Officer (KO) | Resources Officer (RO) | Effects Officer (EFO) | Operations Officer (OPS) — Platform

Knowledge Officer (KO) | Resources Officer (RO) | Effects Officer (EFO) | Operations Officer (OPS) — Platform

Functions of the Commanders →

CKO	CRO	CEFO	COO	Commander
- Situational Awareness - Intel/Comms - Commands all Sensors	- Logistics - Commands all Logistics Assets	- Targeting - Fire Support - Weapon Allocation - Commands Weapons Systems	- Day to Day Execution - Commands Multi-mission Platforms	- Allocates Resources - Courses of Action - Intent - Meta-Cognition

Figure ES-1. Command Relationships and Functions.

Ideally, all assets will be used as one integrated force. However, Mission Commanders (MC) may be activated when the complexity of a mission is high and requires a special focus, to prevent overload of the functional commanders (span of control is too large), or forces are required to leave the mutual protection afforded by forces close together.

Within this organization there are two distinct, yet still interrelated, processes occurring at the same time: planning and execution. The planning process is primarily performed by the force commander and is highly centralized. The execution process is performed by the functional commanders and is decentralized. Because of these to two different processes, the proposed NCW organization is looked at in two "snapshots" during analysis with the Organizational Consultant expert system.

The Organizational Consultant expert system relies on a knowledge base derived from combined literature on organizational theory and human expertise on organizational design. The literature and expertise has been distilled into over 450 "if-then" statements which are used to analyze the organization and produce recommendations on the design of an organization.

Table ES-1 is a summary of results concerning the proposed NCW organization, along with confidence factors, which can range from 0 to 100.

	NCW Organization (Planning)		NCW Organization (Execution)	
SIZE	Large (80)		Large	
CLIMATE	Developmental (76)		Developmental (76)	
MICROINVOLVEMENT	Low (73)		Low (80)	
STRATEGY	Analyzer with innovation (72) Prospector (65)		Prospector (76)	
	Current	Recommended	Current	Recommended
COMPLEXITY	Medium (82)	Low (55) Medium (54)	Medium (82)	Medium (54) High (54) Low (51)
HORIZONTAL DIFF.	Medium (80)	Low (55)	Medium (80)	Low (51) High (51)
VERTICAL DIFF.	Low (80)	Low (79)	Low (80)	Low (59) High (51)
SPATIAL DIFF.	High (80)		High (80)	
CENTRALIZATION	Medium (81)	High (50)	Medium (85)	Low (48)
FORMALIZATION	Medium (76)	Low (71)	High (76)	Low (77)
SPAN OF CONTROL		Moderate (60)		Narrow (58)
MEDIA RICHNESS	High (85) Providing a large amount of information (85)		High (85) Providing a large amount of information (95)	
INCENTIVES	Results (85)		Results (95)	
COORDINATION AND CONTROL	Meetings (86)		Professionalization (100)	
CONFIGURATION	Divisional (69) Matrix (62) Adhocracy (60)		Adhocracy (73) Simple (65)	
SITUATIONAL MISFITS	None		None	
ORGANIZATIONAL MISFITS	Complexity Centralization Formalization Configuration do not match		Complexity Centralization Formalization do not match	

Table 6-1. Results from Organizational Consultant.

Organizational Consultant had additional recommendations calling for less formalization with the NCW organization and empowering lower levels of the organization during the execution process.

The conclusion is reached that the proposed NCW organization fits situationally and, with several changes, can fit organizationally as well, thereby obtaining total design fit.

I.   INTRODUCTION

A.   PRINCIPLE RESEARCH QUESTION

This thesis considers the fitness of a proposed organization for the Navy, designed to operate in a Network Centric Warfare (NCW) environment. The proposed organization is centered on a force commander and four subordinate commanders (to command the functional groupings of Situational Awareness, Logistics, Effects, and Operations). It is envisioned to operate in a NCW environment, along with advanced decision support systems and a robust, secure network.

The research question to be answered is: "Is the proposed organizational structure fit in a NCW environment?"

As defined by Burton and Obel in the text *Strategic Organizational Diagnosis and Design*, "Fit simply means that things have to fit together" (Burton, 1998, p. 285). Although this may seem simple, there are many factors which go into analyzing an organization and ensuring proper relationships exist between the many variable necessary to obtain proper fit. Contingency theory is the basis for the knowledge base developed by Burton and Obel which examines the proper fit of all the variables. This knowledge has been incorporated into an expert system, Organizational Consultant, which will be used to analyze the proposed organization and determine its fitness.

B. REVOLUTION IN MILITARY AFFAIRS

There has been much debate in the last few years about whether or not the military is undergoing a Revolution in Military Affairs (RMA). It has been suggested that for a RMA to have occurred three things need to change - technology, the operational concept, and lastly, organization (Welch, 1996).

Clearly technology has dramatically changed in the last few years. Computer speed and capability is ever increasing and computers are becoming more and more integrated into society. A new operational concept, network centric warfare, has been proposed for the military and is being reviewed and debated by military scholars. This thesis proposes an organization which covers the last part of the RMA - organizational change.

The operating forces of the Navy are still organized to meet a cold war threat and to fight a battle in the open ocean. This organization is the Composite Warfare Commanders (CWC) concept. CWC is focused around Commanders of the Air, Sea, Sub-surface, Strike, and Space/Electronics functions and coordinators to manage the resources (ships, plane, helicopters, etc.) the commanders need to fight. As will be discussed, this a very platform centric way of conducting command and control.

Today the Navy may be called upon to fight in any region of the world, from the littoral environment (which may extend inland over 100+ miles) to the open ocean. The CWC concept of the cold war has served the Navy well, but, given the geopolitical situation of today, we need to take advantage of the possibilities offered by new technologies and concepts.

C. TRENDS IN FUTURE WARFARE

Whether or not we are in the midst of a RMA, warfare is changing dramatically. The tempo of warfare is increasing and the ability (and demand) to coordinate and integrate increasingly complex military operations is itself increasing significantly (OSD/NET Assessment, 1997).

Information has become a prized commodity and may be the key to winning the next war. Major General Paul Funk, U.S. Army, stated, "If this is the information age, then we have to win the information war" (Johnson, 1996, p. 2). We need to be organized to take advantage of, and achieve, information superiority.

The Chief of Naval Operations (CNO), ADM Jay Johnson, has articulated his vision of 21st century naval power as "to influence, directly and decisively, events ashore from the sea - anytime, anywhere" (Johnson, 1997, p. 48). The organization proposed and analyzed here will hopefully bring the United States Navy one step closer to achieving the CNO's vision.

D. IMPORTANT NOTES

The proposed organization is focused on a maritime navy - forces at sea and the capabilities and effects they bring to the battle.

This thesis does not look into the physical network and all issues associated with it (bandwidth, security, etc.). It assumes a robust, secure physical network is in place, with adequate bandwidth to link all forces.

There is no one right organization for all cases - a command and control structure is presented which the author believes will work in most situations to take advantage of new opportunities provided by NCW. Designing an organization is a difficult process. The "best" organizational structure and processes depends on the environment and other variables. Since the Navy can not change organizations to meet every situation and environment, an organizational design is needed which can span the entire spectrum of conflict (peace to war) and be adapted to the circumstances.

The Organizational Consultant expert system software is copyrighted. However, to make it easier to read, the copyright symbol will not be used.

The thesis will begin by examining characteristics of command and control structures and processes. Then, with the background of C2 established, examine NCW, followed by a proposed organization for the Navy designed to thrive in a NCW environment. Contingency theory will be reviewed to provide an understanding of the Organizational Consultant expert system. The proposed organization will then be analyzed using Organizational Consultant and the results will be discussed. The thesis will end with issues, conclusions and recommendations.

II. COMMAND AND CONTROL ISSUES

Some of the issues discussed in this chapter are characteristics of a command and control structure and decision process. These issues are highly interrelated and need to be understood as they are important to consider when designing a military organization.

A. ORGANIZATIONS

What is an organization? "Organizations are social entities that are goal directed, deliberately structured activity systems with an identifiable boundary" (Jones, 1985). The basic building block of an organization is an individual. Individuals in the organization interact to perform functions and processes for the organization. The organization exists to accomplish a set of goals and is structured to achieve them.

An organizational structure is "the sum total of the ways in which its labor is divided into distinct tasks and then its coordination is achieved among these tasks" (Mintzberg, 1993). How one organizes can complicate or simplify problems of execution (MCDP 6, 1996, p. 87).

For efficient and effective operation of an organization, there needs to be a natural fit within the organization (internal consistency), the tasks or goals the organization will perform and achieve, and the environment within which the organization will operate.

B.   ROLE OF ORGANIZATIONS

1.   Information Processing

A fundamental role of an organization is information processing. "An organization processes information in order to coordinate and control its activities" (Burton, 1998, p. 45).

Information, and the processing of information, can be more precisely defined when it is viewed as a part of an overall cognitive hierarchy. Humans are a necessary part of the organization and the processing of information. Figure 2-1 shows the cognitive hierarchy (NDP 6, 1995, p. 21).
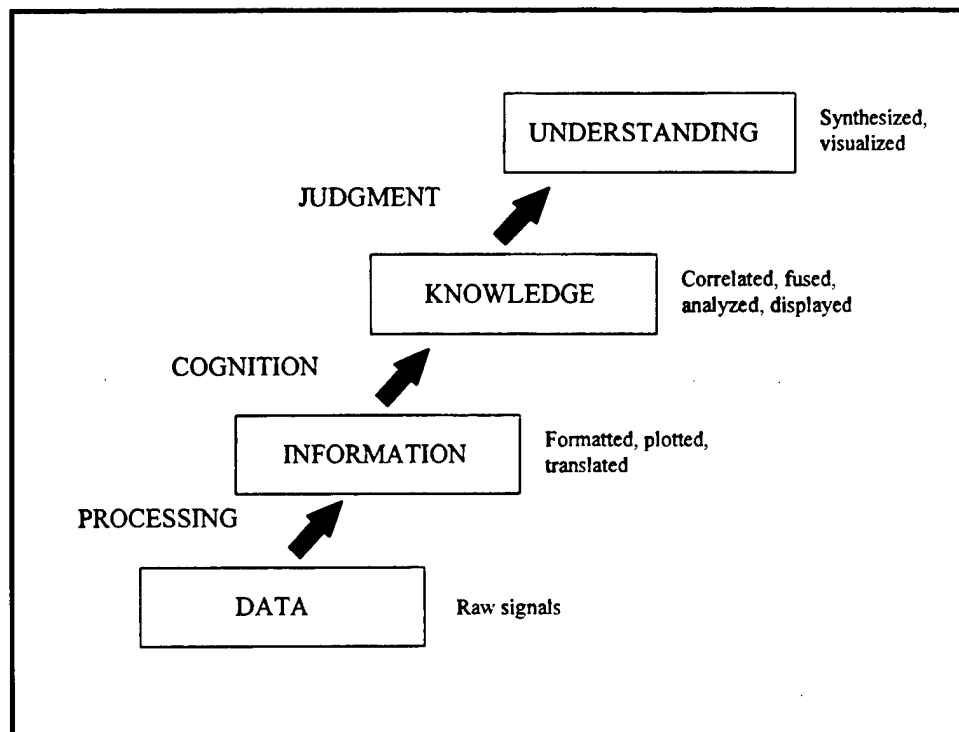
Figure 2-1. The Cognitive Hierarchy (NDP 6, 1995, p. 21).

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The first step toward understanding is gathering raw data. Raw data may be a visual observation, transmission of bits or bytes via a computer, or any other basic signal source. This data must be processed, formatted, collated, filtered, or displayed into information objects developed from experience and experimentation to become meaningful information. Information in this sense is the first form of data rapidly assimilated by humans. This gathered information allows us to generate knowledge through cognition - learning, integrating, and applying thought to the different pieces of information. This process modifies the original information objects and creates knowledge objects. Finally, by using human judgment, this knowledge can be transformed into understanding. Once understanding has been achieved, decisions which support the goals of organization can be made. (NDP 6, 1995)

Information used by an organization is most useful when it is not tightly controlled (Roman, 1996). Allowing everyone in the organization to have access to information, subject to security concerns, of course, allows more assimilation of information so understanding can be more rapidly achieved throughout the organization. The result is that decisions can be made quickly and efficiently by the responsible and empowered people in the organization. This provides the basis for integrating the diverse tasks being performed into a focused unity of effort.

2. Deal with Span of Control

Organizations, specifically the organizational structure the organization employs, must manage the span of control of individuals. The driver in choosing the size of the span of control is the limited information processing capability of individuals.

Span of control refers to both the number and types of things the responsible person must coordinate and control. A person may be able to handle a large number of items if they are all similar, but may only be able to manage a few, diverse items. The optimal number of items, or people, under one person's span of control is situation dependent.

When the span of control is too large, the individual may be presented with too much information for them to process, possibly resulting in missed opportunities. Another person must be added to the organization to keep the span of control manageable.

There is a trade off which must be made between the organization's depth (layers) and width (span of control). In general, narrowing a span of control means deepening the organization's number of layers. The more layers an organization has, the longer it takes for information to move up and down the formal channels, potentially resulting in a less responsive information processing capability. Also, more layers in an organization will increase the number of people that information must flow through. Each individual must decide what to do with that information - act on it, ignore it, or pass it on to someone else.

Deciding to flatten an organization by removing layers of people, will decrease the nodes the information must pass through and increase the speed at which information can be processed. However, this will widen the span of control and increase the reliance on lateral or informal communication. (NDP 6, 1995)

C. COMMAND AND CONTROL

The definition of Command and Control (C2), according the Joint Chiefs of Staff is, "the exercise of authority and direction by a properly designated commander over assigned or attached forces in the accomplishment of the mission. Command and control functions are performed through an arrangement of personnel, equipment, communications, facilities, and procedures employed by a commander in planning, coordinating, and controlling forces and operations in the accomplishment of the mission." (Joint Pub 1-02, 1995, p. 78)

Command and control is both a process and a system by which a commander decides which actions are carried out and directs their execution. The words "command and control" can be viewed as nouns, and used in this way command and control describes a system - an arrangement of different elements interacting to produce an integrated action. (MCDP 6, 1996) The basic elements of a command and control system are people, information and the support structure to carry out command. "Command and control", viewed as a compound verb, describes a process - a collection of related activities. (MCDP 6, 1996) Viewed this way, command and control is an active process; something to be done.

D. COMMAND AND CONTROL AS A COMPLEX SYSTEM

. Command and control is a complex system and process. As such, it is composed of multiple parts, each of which must act individually according to its own circumstances and, by doing so, changes the circumstances affecting all other parts (MCDP 6, 1996).

Effective C2 must be sensitive to changes in the interactions of competing complex systems, both ours and the enemy's. It is unreasonable to expect C2 to impose precise, predictable, and well-defined order on a complex undertaking like war. Effective C2 must facilitate rational decisions in the midst of chaos. C2 melds the continuous adaptation between competing complex systems.

E. DECISION CYCLE AND COMMAND AND CONTROL AS A PROCESS

The decision and execution cycle, pictured in Figure 2-2, characterizes the command and control process. (NDP 6, 1995, p. 17)
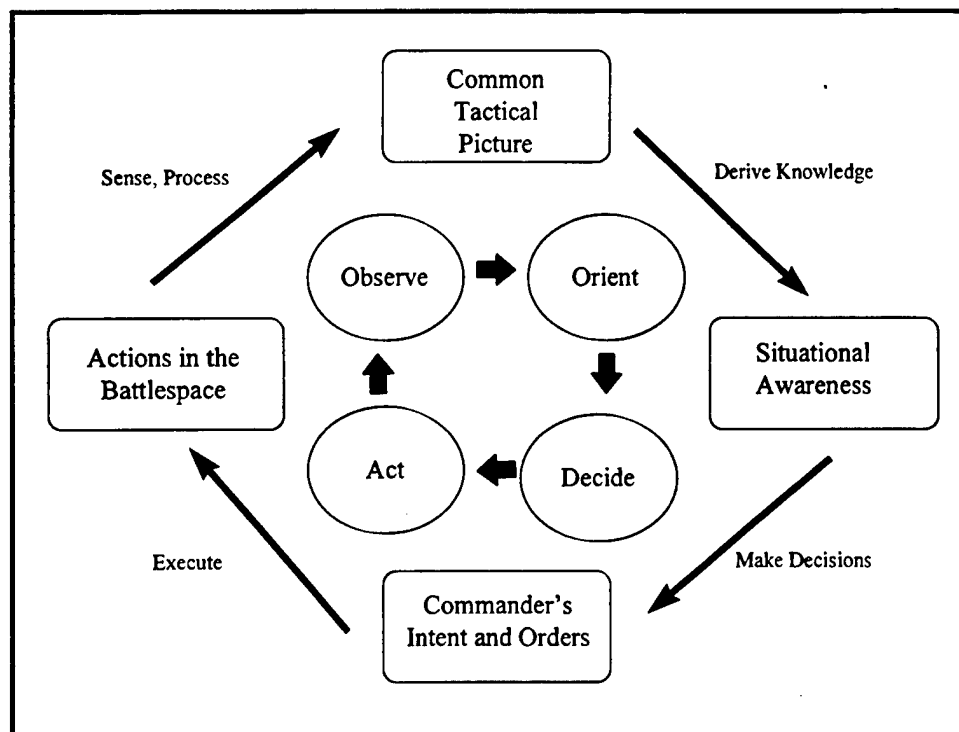
Figure 2-2. The Decision and Execution Cycle.

It is based on the classic Observe, Orient, Decide, Act (OODA) loop and models each side (friendly and enemy) which meets in the environment where actions are carried out. The OODA loop is a simplification of a complex process, but clearly shows the process of command and control.

The loop starts with gathering information about the enemy's forces (such as intent, capabilities and disposition), friendly forces, and the environment in which they operate. The next step is to evaluate that information in the context of the situation for which a decision is to be made. Gathered data must be timely, relevant, and useable (recall the cognitive hierarchy, Figure 2-1), perceptions must be validated, and understanding achieved. The third step is to decide what action (or no action) to take based on the situation. Lastly, the decision is translated into action where something is done in the environment - an action is taken on the battlefield. This process is continuous and relies on constant feedback (new observations) to carryout the cycle. There can be OODA loops within OODA loops for some complex decisions.

F.   ROLE OF TIME AND TEMPO OF OPERATIONS

The Navy defines tempo as "the pace of action - the rate at which we drive events" (Roman, 1996, p. 9). One way of doing this is to exploit the dynamics of combat by maintaining a high tempo of operations. Whoever can make and affect implementation of decisions consistently faster, gains a tremendous, often decisive advantage. Decision- making thus becomes a competitive process with regard to time,

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where timeliness of decisions becomes essential to generating and controlling tempo. (FMFM 1, Warfighting)

However, generating a fast tempo of operations can cause ineffective or incorrect decisions to be made. It is important to allow sufficient time to understand the battlefield and available options, so that the a high quality, yet still timely, decision can be made. Also, moving too fast can cause your opponent to not understand your intentions and miss your implied message (the hopelessness of the situation) and your intended manipulation of the enemy's actions may not occur.

Alan Krulisch (1998) developed a model using a Monte Carlo simulation to examine speed of command versus decision quality. His conclusion is that increased speed of command provides increased probability of mission success, but if one must sacrifice quality to gain speed, any advantage can dissipate rapidly. There is a balance between rapid actions, risking poor quality decisions, and acting too slowly to maximize decision time and losing the competitive advantage. Controlling the tempo of operations can result in ensuring a higher likelihood that the battle unfolds in your favor.

G.   CENTRALIZED VS DECENTRALIZED CONTROL

Control of operations can be either centralized, decentralized, or a long spectrum between the two.

Centralized control, called detailed control according to Navy doctrine (NDP 6, 1995, p. 26), works best when there is great certainty in the environment and little time pressure. Detailed control can also be described as coercive - the commander holds a

tight rein over the organization with information flowing up to the commander and orders flowing down from the commander. (MCDP 6, 1996) Orders and plans are detailed and explicit and their success requires strict obedience, minimizing subordinate initiative and decision making. It has been said that the RMA may lead to pressure to centralize control (Fukuyama, 1997, p. 52). With technological ability increasing rapidly, the commander may be able to see everything subordinates see and direct their every move from headquarters.

At the other end of the spectrum is decentralized, or mission, control. (NDP 6, 1995, p. 26) Here the commander has a loose rein over the organization. The commander guides the actions of subordinates by imparting an understanding of mission requirements (commander's intent) and then allowing them freedom of action (NDP 6, 1995, p. 27). Mission control can be described as spontaneous - unity of effort is not the product of conformity imposed from above, but from the spontaneous cooperation of all the elements in the organization. (MCDP 6, 1996) Lab tests indicate that teams placed under increased stress operate more efficiently and correctly when there is less shared uncertainty coupled with decentralized control (Roman, 1996, p. 6). Shared uncertainty can be reduced by lateral coordination or mutual adjustment between members of the organization. Whether done formally or informally, coordination between different groups in an organization can help the flow of information and allow more efficient operations. This mutual adjustment keeps organization running efficiently.

In reality, no commander will use solely either detailed (centralized) or mission (decentralized) control. The exact type of control will depend on a variety of factors, such

as the nature of the task, the operating environment, capabilities of the enemy, and the abilities of the organization's people.

H. UNITY OF COMMAND

Joint Publication 1, Joint Warfare of the U.S. Armed Forces, states "unity of command is the guiding principle of war in military command relationships." Unity of command necessitates that the commander should communicate with everyone involved in the operation. It demands that everyone in the force have an understanding of what their role is in the organization. The commander must articulate his vision, by means of the commander's intent, so that everyone in the organization is operating from the same basic understanding of the desired end state and how to achieve that state. Doctrine can play an important role in achieving unity of command.

Unity of command is not synonymous with unit of effort. Unity of command facilitates unity of effort. Unity of command is an organizational concept, while unity of effort is an operations concept. Unity of effort can help ensure harmonious and coordinated action by all members of the organization. (NDP 6, 1995, p. 53)

I. COMMANDER'S INTENT

Commander's intent describes to subordinates the end goal they are working towards and under what operational constraints. It provides the big picture, or vision, to subordinates. It allows them to know where the commander wants to be at the end of certain time (T + time x). In certain situations the guidance may be very restrictive (detailed control), in others, very loose (mission control), depending on the stability of

the situation, experience level of the force, how well the goal can be defined and the political sensitivities of the operation. In either case, a well drafted intent can help ensure success of the operation.

An excellent historical example of the utility of the commander's intent is Admiral Horatio Nelson's command of the British fleet in the early 1800s. He believed the best way to achieve a decisive victory was to give his subordinates a thorough indoctrination before the engagement (a clear commander's intent) and then allow them great initiative once the battle began. Admiral Nelson only used three general tactical flag hoist signals to maneuver the British fleet during their victory at the Battle of Trafalgar. (NDP 6, 1995, p. 5) His intent was clear and his subordinates knew the desired end state.

Gary Klein (1998) makes a powerful argument concerning functions of the intent as well as important actions in developing the intent. His research documented some of the outcomes seen when subordinates understand the commander's intent. The two greatest advantages are promoting independence and improvisation. Independence in an organization can improve performance because there is less need for clarification. It also gives them a chance to make better use of their expertise and experience in anticipating problems, catching errors, and detecting deviations from the assumptions of the leader.

By promoting improvisation the organization is capitalizing on the advantages of decentralization. People react without waiting for explicit permission. They recognize opportunities that were not necessarily part of the plan but contribute to its execution.

Understanding the intent, they can set and revise their own priorities and continue with tasks without pausing for receipt of the next order.

Karl Weick (1993) published a streamlined version of five items necessary for communicating intent:

- Here's what I think we face,

- Here's what I think we should do,

- Here's why,

- Here's what we should keep our eye on,

- Now, talk to me.

Clearly, the intent helps the organization 'read the mind' of the boss. Commander's intent is critical for success and unity of effort.

J.   PLANNING

Planning is an important part of the process of command and control. A plan is a proposed sequence of actions to transform a current state into a desired state. (Klien, 1997) The most important function of a plan is to solve a problem. The organization is faced with a problem (a mission) or situation (an environment) and must determine how to proceed (a strategy) to achieve the desired end state. A plan will direct and coordinate the actions of the organization's members.

A plan can also shape the method of thinking of the planners. Although "no plan ever survives first contact with enemy" (Prussian Field Marshal Moltke in, MCDP 6, 1996, p. 21), the process of putting together the plan can be just as valuable as the final

plan. Considering the limitations and options available and what alternatives may or may not work, can prove to be valuable when the initial plan breaks down and adjustments are made to the operation.

A plan can support improvisation after the operation begins. When the plan does not become reality, the plan, and the planning process, can make it easier to generate an alternate course of action that will be compatible with the actions of others. The plan itself can become a platform for improvisation in order to achieve the goals and mission of the organization. (Klein, 1997)

A plan may be developed over a long period of time (deliberate planning) or a plan maybe put improvised very quickly to respond to a crisis (crisis action planning). In either case, a key point to remember about the planning process is that the job of the organization is to achieve a mission and accomplish its goals. Plans are not the end objective - mission success is the objective. Plans do break down and sometimes very quickly. It has been found that plans generated by U.S. Army division level staff will typically become obsolete in 5 hours, even though the planning cycle itself could take up to 5 hours (Klein, 1997). A plan should serve as a useful platform for making changes and improvising to meet any unexpected situations.

K.   ADAPTATION

One command and control structure will not fit every situation. The organization needs to be adaptable in both the structure of the organization, as well as the processes it

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uses. Research has shown that superior teams have one key quality in common - the ability to adapt to task demands. (Serfaty, undated)

Organizations that face highly uncertain environments, such as the Navy, need high levels of flexibility and adaptability to cope with the rapid changes. These organizations are likely to be less bureaucratic and more decentralized (Bolman, 1991). An adaptive structure is more effective than a bureaucratic one in improving overall organizational performance (Bhargave, 1992).

In the future war fighting environment, only fast-paced, adaptive organizations will succeed. (Roman, 1996, p. 11) A command and control organization is needed that can adapt quickly in a complex environment, maintain control of the situation, and achieve the end goals of the organization.

L.   CONCLUSION

The command and control characteristics and issues discussed in this chapter are vital to mission success. They will be used as NCW, the proposed organization, and the results from Organizational Consultant are described. These characteristics, affecting both structure and process, are highly interrelated. How one characteristic or issue is carried out or changed may have a profound effect on another.

III. NETWORK CENTRIC WARFARE (NCW)

This chapter on Network Centric Warfare (NCW) is presented to enable the reader to understand the warfare environment within which the proposed organization will operate.

A. HOW DID NCW START?

The first glimpse into NCW was seen in 1991 during the Gulf War, where U.S. interconnected forces, equipped with superior information and highly maneuverable weapons platforms, devastated an entrenched and immobile adversary (Iraq) in a very short period of time. It demonstrated a new offensive paradigm: the force that executes so quickly and powerfully that the enemy is left with only two options: surrender or annihilation (Stein, 1998a).

NCW began to emerge in 1996 when Vice Admiral Art Cebrowski (then the Director of Command Control, Communications and Computers (J-6) for the Joint Chiefs of Staff) and Ms. Anita Jones (the Director, Defense Research and Engineering for the Office of the Secretary of Defense) initiated the Advanced Battlespace Information System Study (ABIS). This study looked at how emerging information technologies could be used to provide the warfighter with new and enhanced capabilities. After the completion of this study, ADM Cebrowski began to detail some of the tenents needed for NCW, and other military leaders began to discuss his vision for future warfare.

B. WHAT IS NETWORK CENTRIC WARFARE?

Network Centric Warfare, whose goal is to terminate conflicts very quickly and not allow wars of attrition to develop, is the military's response to information age conflicts. Information technology has changed the way our society operates and has changed the underlying rule set used in the business world. Information is beginning to emerge, as was seen in the Gulf War, as a dominant tool of war (N816, 1998).

NCW can be defined as a system of warfare that derives its power from the robust networking of a geographically dispersed, but knowledgeable, force. NCW is applicable to all levels of warfare and contributes to the coalescence of strategy, operations, and tactics. It is transparent to mission, force composition, and geography. (Cebrowski, 1998)

Admiral Jay Johnson, Chief of Naval Operations, has said of this new system of warfare, "... it's a fundamental shift from what we call platform centric warfare to something we call network centric warfare." (Cebrowski, 1998) Platform centric warfare is very linear - add more ships or capability and a linear result is obtained. In NCW, the payoff is non-linear, possibly exponential. Metcalf's Law describes the exponential payoff. Robert Metcalf stated "The power (value) of a network increases as the square of the number of nodes in the network." (Stein, 1998c) NCW is interested in connecting and increasing the number of nodes in the network to gain the exponential payoff of the new warfare system.

C. PRINCIPLES/TENENTS OF NCW

NCW is enabled by four interrelated supporting elements: Enhanced Situational Awareness, Self-Synchronization, Speed of Command, and Offensive Distributed Firepower.

1. Enhanced Situational Awareness

Enhanced situational awareness is a prerequisite for NCW. Without it, NCW will not work. Enhanced situational awareness requires four things: accurate sensors, robust sensor fusion, information systems that support human decision making, and dominant operational knowledge. Situational awareness is generated by combining accurate sensors and a sensor fusion process which takes full advantage of technological advancements. Information systems must be able to take the fused sensor data and enable decisions to be made in the uncertain and complex battle environment. The combination of accurate sensors, advanced fusion processes, and systems which support human decision making, may allow our forces to obtain dominant knowledge of the battlefield situation. We must know more about the environment than the enemy does so we can control and manipulate the environment to support our desired outcome. When these four elements are combined, we will have an enhanced awareness of the environmental situation. This is the driving need for developing a common understanding of the battlespace (N816, 1998).

2. Speed of Command

Speed of command can be defined as: "The process by which a superior information position is turned into a competitive advantage." (Cebrowski, 1998, p. 35)

Speed of command allows the networked force to rapidly respond to internal direction and external stimuli and move quickly towards a unified goal (N816, 1998).

Speed of command, as envisioned in NCW, will lock in our success while at the same time locking out enemy alternatives. We want to force the enemy to do our will; we want the enemy to perceive only two options: surrender (and do our will) or be annihilated.

Speed of Command has three parts or phases. One, the force, having an enhanced situational awareness of the environment, achieves and maintains, information superiority. Our forces need to know more about what is going on in the environment than the enemy. Two, our forces, acting with speed, precision, and reach, are able to mass effects (not necessarily massing forces). The key is achieving the desired effect, not the specific forces, platforms or weapon systems used to get the effect. Lastly, after achieving the desired effects, the enemy's options are reduced: surrender or be annihilated (Cebrowski, 1998, pp. 32 and 35).

Speed of command is all about controlling the speed or tempo of an operation as a result of understanding the context of the situation better than the enemy. By controlling the speed of command, our decision cycle (OODA loop) will function faster than the enemy's. This enables us to act upon the battlespace more rapidly than the enemy, who will not be able to keep up with our actions.

3. Self-Synchronization

Self-synchronization can be defined as: "The ability of a well informed force to organize and synchronize complex warfare activities from the bottom up." (Cebrowski, 1998, p. 35)

This definition may seem simple, but the process can be difficult. Self-synchronization is similar to a jazz ensemble conducting an improvisation session. Each of the band members knows his/her role in how the music is played and steps up for a solo part for a short period of time. Members communicate with each other through the music and subtle head, eye, or hand gestures. There may still be a leader of the group (for bookings and other administrative matters), but during a music session, each member is playing a certain role which everyone understands.

Another analogy can be made with a soccer game. Each player has a specific role (a position) and there may be set plays (i.e. a corner kick) but for the majority of the game the environment (made up of the field, the ball, and the two teams) is constantly evolving and changing. Players know what to do because they have spent many hours practicing and interacting with each other. They adapt as the game changes, synchronizing their individual movements or actions with actions of teammates as each role changes during the game.

In a soccer game the objective is clear - score as many goals as possible without having goals scored against you. For the military to self-synchronize, the strategic objective will need to be just as clear. The commander will need to craft the intent so that

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it is easily understood by everyone involved. Additionally, everyone will need to have a common understanding of the doctrine used by the force.

Warfare is much more complex than a jazz session or soccer game and the costs are much greater. Thus, self- synchronization may be much harder to achieve. Unity of effort must be established, intent of the commander made clear, and rules of engagement must be unambiguous and applicable to the situation.

4. Offensive Distributed Firepower

Massing of effects, not massing of forces, is the key to Offensive Distributed Firepower. Sharing of information between platforms, allows the firepower of the force to be distributed in the most efficient manner. No longer are weapons limited by the range of the onboard sensors. Forces can coordinate maneuver and fires in a distributed fashion so that they impact the enemy where it hurts, when it hurts the most and capitalize on the lethal range of modern and emerging weapons. (N816, 1998)

D. GRIDS

Three elements make up the physical grid of NCW. The first element is a high performance information grid allowing ready access to all appropriate information sources. Second is an integrated sensor grid, closely coupled temporally to shooters and C2 assets. Third is a shooter grid for weapons reach, maneuver (along with precision), and speed of response. (Stein, 1998b)

1. Information Grid

The information grid is a fundamental building block of information superiority. The information grid is a "network of networks" consisting of communication paths, nodes, operating systems and information management applications that enable network centric computing and communications across the force. The connectivity and computing capabilities of the information grid enables manipulation of the sensor grid to build and generate battlespace awareness.

The information grid consists of both military and commercial communications capabilities. It supports multiple information types in various modes at diverse data rates. Voice, data, and video can be transmitted via point-to-point or direct broadcast. The information grid provides for information protection to assure information availablity and integrity. The combination of these capabilities enables the information grid to provide the warfighter with high speed access to the information required (Stein, 1998b).

2. Sensor Grid

The sensor grid is composed of air, sea, ground, space, and cyberspace-based sensors. Sensor grid elements include dedicated sensors, sensors on multi-mission platforms, sensors employed by individual soldiers, and embedded logistics sensors. The sensor grid is the means used to provide the force enhanced situational awareness (Stein, 1998b).

The sensor grid may be reconfigured for specific missions or may remain intact for a long period of time. This grid encompasses the required physical elements (sensors), processes (most likely enabled or automated by software applications for data

fusion), and allows human interaction when necessary to achieve enhanced situational awareness. Both sensor tasking and data fusion will occur on the sensor grid.

3. Shooter Grid

This grid is where targets are dynamically matched with weapons by the use of high speed automated weapon-target pairing algorithms. These algorithms do not take the commanders out of the loop, rather they allow the commander to focus his attention on other areas and let computers do what they were designed to do - compute massive bits of data/information at an ever increasing speed. The shooter grid enables the warfighter to plan and execute operations in a manner that achieves an overwhelming effect at a precise place and time. The shooter grid is where the intentions of the commander are translated into effects on the enemy and the manipulation of the environment.

E. EXAMPLES OF NCW

Even though NCW has not yet been achieved in the military, some elements and precursors of it can be seen in the commercial sector, government systems, and certain military capabilities.

1. Commercial

a. *Wal-Mart*

Using information to provide an enhanced awareness of the competitive market place can be seen in the business practices of Wal-Mart. Wal-Mart has used information to gain a competitive advantage over its competitors. Realizing that it had

grown past the point where it could cost-effectively synchronize supply and demand, the company set up an architecture consisting of a sensor grid and a transaction grid. Point of sale scanners (part of the sensor grid) collect information on each transaction and this information is shared directly with Wal-Mart's suppliers in near real-time so that production and distribution can be better controlled. Originally, Wal-mart had a central purchasing department, but the need for this disappeared as information on sales (and hence re-supply) was shared with suppliers.

All of the information from Wal-Mart's transaction grid is stored in a central data-warehouse and shared between Wal-Mart's regions and stores. This allows better awareness of the competitive retail system and allows Wal-Mart to adjust inventory levels between stores and adjust prices to increase sales and profits. Information is the key to Wal-Mart's success and advantage over its competitors. (Cebrowski, 1998)

b. Deutsche Morgan Grenfell (DMG)

Deutsche Morgan Grenfell (DMG), a fixed-income securities market firm, has used information to allow an enhanced awareness of the financial market. They introduced an automated trading service called Autobahn which has changed the way they do business.

In the old system, customers worked through DMG traders to initiate and complete transactions. The trader would be involved with every aspect of the trade from price assessment to execution. A trader could only handle a limited number of customers.

Since large trade customers generated more revenue, they had priority over smaller traders.

In the new system, all transaction are conducted over a network via electronic transfer (a transaction grid). Customers (both large and small) are now aware of the market price in real time (enhanced situational awareness) and can complete transactions in seconds. This has been beneficial to both DMG and its customers. DMG can now handle a larger volume of trades, since traders are no longer needed, and both large and small customers can have their trades completed in mere seconds. Information leading to enhanced situational awareness has been the key to this transformation. (Cebrowski, 1998)

2. Government

a. Federal Emergency Management Information System (FEMIS)

The Federal Emergency Management Information System (FEMIS) is an example of a system that allows sharing of enhanced awareness required in emergency situations.

FEMIS is an integrated system that provides planning, coordination, response, and exercise support for emergency management. It is an automated decision support system that integrates all phases of emergency management. A personal computer based system, it makes it possible for emergency management personnel to anticipate and plan for a wide variety of event conditions. Computers are linked via modems to a central server so that everyone on the network has access to the emergency plan and can

visualize, via status boards and in near real-time how the plan, and its modifications are progressing. Color coding makes it easy to see what actions have and have not been taken, and which ones are in progress. FEMIS generates a common understanding, in near real-time, of the emergency situation. This enhanced situation awareness allows relevant actions to be taken by emergency personnel. (FEMIS, 1995)

3. Military

NCW concepts are beginning to emerge in the military today. Two examples are provided below: Cooperative Engagement Capability (CEC), and Theater Ballistic Missile Defense (TBMD).

a. *Cooperative Engagement Capability (CEC)*

The Navy's CEC is an example of using networked information to increase combat power. CEC allows a contact to be tracked by one set of platforms and engaged by a separate platform set, without the shooting set ever having directly (organically) sensed the hostile contact. The contact data is placed on a sensor grid which is updated and shared between platforms quickly and precisely enough that the contact information is fire control quality (accurate and timely enough for a missile attack). The sensor grid is able to support an enhanced situational awareness between all networked participants (via the information grid) that allows shooters to initiate an engagement quickly and without ever having to be within organic sensor range of the target, contributing to force survivability as a by-product.

b. *Theater Ballistic Missile Defense (TBMD)*

Theater ballistic missile defense (TBMD) is similar to CEC. While it is on a much larger scale (theater wide vice a tactical level), the concept is the same. As hostile ballistic missiles are fired, they are detected by friendly sensors and updated to the sensor grid. Other participants in the network use the information on the sensor grid to conduct an engagement via the shooter grid using targeting data provided by other platforms.

F.   CONCLUSION

This chapter has described network centric warfare and the tenents and grids which comprise NCW. It has shown how critical these tenents are to the success of NCW and provided examples of some of these tenents.

Due to the radical shift from platform centric warfare to NCW our current organizational structure will need to change. Fred Stein stated that as a result of NCW "Basic organizations that were optimized for traditional top-down command and control will have to change." (Stein, 1998c) The next chapter proposes an organization which is designed to thrive in a NCW environment.

IV. PROPOSAL FOR A NAVY ORGANIZATION IN A NCW ENVIRONMENT

A. INTRODUCTION

An organization was proposed by the author, along with Captain Michael LeFever, during the Chief of Naval Operations Strategic Studies Group (SSG) XVII (SSG XVII, 1998). Although this organization was developed and thought about during the SSG, many of the ideas presented here are different from those presented in the SSG report. The ideas presented here are those of the author and not necessarily of the SSG.

This organization is designed to operate in a NCW environment. It is not designed for one specific mission, rather it is flexible and adaptable so it can be changed to suit the mission in both objectives and scale, while still retaining the same basic functional elements.

It has been said that "the challenge for the U.S. military is to develop new organizational structures that achieve the efficiencies and creativity businesses have gained in the virtual and reengineered environments, while at the same time retaining the elements of the traditional, hierarchical, command and control system essential for operations in the combat arena." (Huber, 1996, p xiii) The author believes the organization presented below meets this challenge as well as the new opportunities provided by NCW.

B. ORGANIZATION

The core of the organization is no longer centered around commanders of platforms (the platform centric view). It is focused on the functions and processes that the force, which obviously is still comprised of platforms, will need to self-synchronize. There will still be commanders of platforms (e.g. ship commanding officers) however there will be a fundamental change in their roles and responsibilities. They will become, similar to the Chief of Naval Operations today, responsible for "manning, training, and equipping" the platform. The fighting of platforms will be done by a different organization. It is important to note that a ship commanding officer could be "dual hatted" as both the platform commanding officer and one of the functional (warfighting) commanders presented below.

All of the weapons brought to the fight by a platform will be available for the entire force to use, not just for the one platform. We will no longer "fight the platform" (except in self-defense), we will take advantage of the distributed offensive firepower of the entire force and the combined effects the weapons bring to the fight.

To carry out the advantages of using the distributed offensive firepower of the entire force, the basic organization is composed of the Force Commander, a Situational Awareness function, a Logistics function, an Effects function, and Operations function. This organization, with the commander of each function, is shown in Figure 4-1.

Basic Organization

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                    ┌──────────────┐
                    │    Force     │
                    │  Commander   │
                    └──────────────┘
                           │
      ┌────────────┬───────┴───────┬────────────┐
┌───────────┐┌───────────┐┌───────────┐┌───────────┐
│   Chief   ││   Chief   ││   Chief   ││   Chief   │
│ Knowledge ││ Resources ││  Effects  ││ Operating │
│  Officer  ││  Officer  ││  Officer  ││  Officer  │
│   (CKO)   ││   (CRO)   ││  (CEFO)   ││   (COO)   │
└───────────┘└───────────┘└───────────┘└───────────┘
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| Situational Awareness (SA) Function | Logistics (LOG) Function | Effects (EFF) Function | Operations (OPS) Function |
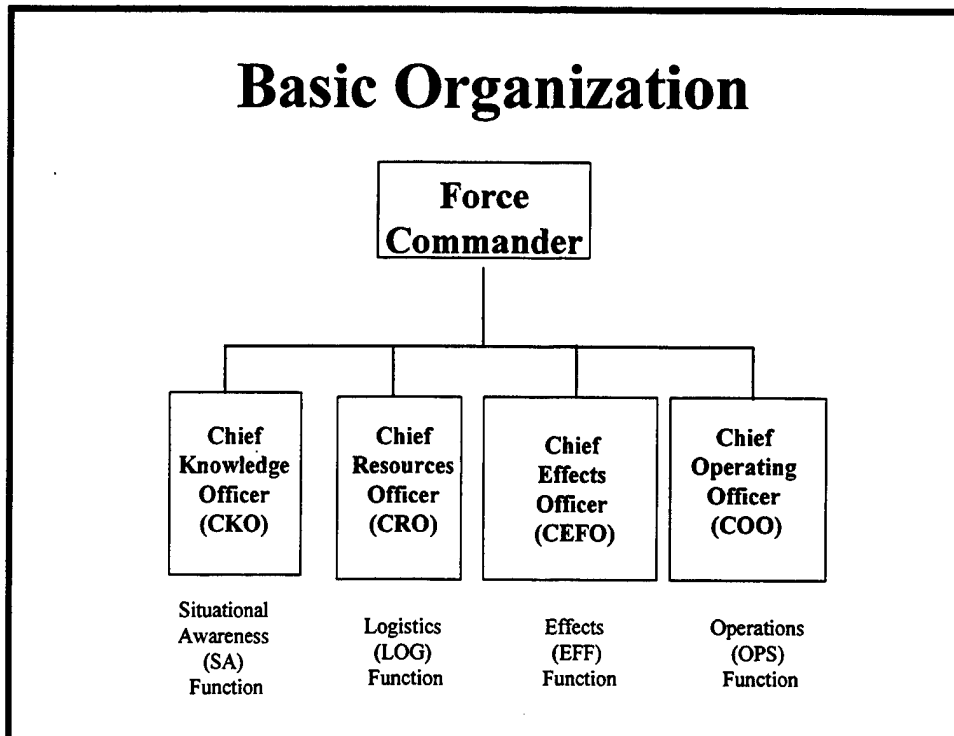
Figure 4-1. The Basic Organization.

In certain situations (described later in this chapter), a Mission Commander role may also be activated.

1. Force Commander

The most obvious role of the force commander is to command the force. The Commander is, and should always be, responsible for the actions of the forces assigned. The commander has several specific roles, each a part of command: resource allocation, promulgation of intent, decide on courses of action, develop and maintain situational awareness, and perform a meta-cognitive function.

a. Resource Allocation

When there is a requirement to perform any task the commander must allocate resources to complete the task. Resource allocation is not an easy chore because many times assets are scarce and they must be distributed across many tasks, all competing for resources. Some assets may have multiple capabilities (e.g. sensors and shooting). This further complicates the resource allocation function.

b. Decides Courses of Action (COAs)

There are numerous ways to accomplish a mission, but there may only be a few feasible or satisfying solutions. Generally, the staff will generate several COAs to the commander using decision support systems and modeling and simulation tools. The commander, using these aids, will select a particular COA or a combination of COAs and then direct it to be carried out. This becomes the commanders intent.

c. Commander's Intent

As discussed in Chapter II, the commander must promulgate his/her intent so the forces know what end state they are striving to achieve. Without knowing the intent, there is no way for self-synchronization to occur. It is the understanding of the desired end state, not necessarily how to get there that matters, although collaborative planning and, in certain situations, being told how to achieve the end state, can help.

Events on the battlefield will occur too fast for the commander to dictate every action - centralized control will not work. The intent enables subordinates to anticipate the commander's desired and take actions to implement them.

d.   *Develops and Maintains Situational Awareness*

It is imperative that the commander have the "big picture". Overall situational awareness must be maintained to effectively integrate and utilize the force elements. It is of utmost importance that the commander's staff, and the other command functions, provide the right information to the commander at the right time and in the right form.

Information management is the key in providing situational awareness. To prevent overload or fixation on extraneous data a common integrated picture (CIP) must be developed and maintained on the net so everyone has access to consistent information. The Chief Knowledge Officer (CKO) of the organization is responsible for building and presenting this common integrated picture to the commander and the rest of the force.

e.   *Meta-Cognitive Role*

In an organization there has to be someone who can step back from the current situation and assess how the organization is performing. Meta-cognition means "thinking about thinking". There is no one better than the commander (possibly with the Chief of Staff) to do this function. Self-critique is invaluable for improvement and adaptation to occur. The recognition of limitations, either your own, the staff's, or the organization's is the trigger for adaptation. Correcting or mitigating them is central to adaptation.

Meta-cognition should be addressed at two levels in the force: the staff (is the commander being supported effectively by the staff?) and the organization of the

entire force (is the force organized for efficient performance or is there a better way to do things?).

2. Chief Knowledge Officer (CKO)/Situational Awareness (SA)

The Situational Awareness (SA) function is a combination of the intelligence (the "2") and communications (the "6") functions of today and is commanded by the Chief Knowledge Officer (CKO). It is the CKO's job to manage all information in the force. Information will be managed as a pooled resource, with direct access controlled according to security control and access privileges. But the CKO is not merely a manager of information; the CKO is a commander. The CKO has direct command over all dedicated sensor systems which may reside on multi-mission platforms, like a radar on a ship, or may be solely dedicated to gathering situational awareness information, like unmanned aerial vehicles (UAV). The CKO will control these assets to effectively gather knowledge and build the enhanced situational awareness upon which the force will rely. To coordinate these assets on each platform, the CKO will have Knowledge Officers (KO) under his command. KO are working for the CKO to build the situational awareness for the force.

The CKO also maintains the CIP showing positions of friendly, enemy, and neutral platform and assets, as well as, any unresolved contacts. The CIP must show where ambiguities in contact information exist. CKO coordinates all national assets and brings the right information to the force from national sources. CKO identifies gaps in sensor and intelligence coverage and takes action with his dedicated assets to maximize the coverage. CKO must also be able to display where these gaps in sensor and

intelligence coverage exist. It is the CKO's job to maintain all communications assets, as well as ensure the security of those communications. CKO must protect our physical systems are protected from exploitation by the adversary (defensive information warfare). CKO also attempts to predict the enemy intent. During offensive attacks, the CKO performs all battle damage assessment.

3. Chief Resources Officer (CRO)/Logistics (LOG)

The Chief Resources Officer (CRO) is responsible for the logistics support of the entire force. The CRO ensures re-supply and delivery, from the source to the user, of all food, munitions, parts, POL (petroleum, oil and lubricants) and personnel. This re-supply is based on anticipated usage and actual consumption rates. If required, the CRO is responsible for any salvage activities or contracting actions which may need to be done in theater. The CRO also maintains the logistics database.

The CRO is a commander of the logistics platforms and resources which will carry out re-supply of the force. On each platform is a Resource Officer (RO) who will carry out the direction of the CRO.

4. Chief Effects Officer (CEFO)/Effects (EF)

Effects is where decisions are made concerning fighting the battle which enables leveraging of the distributed offensive firepower of the force. The Chief Effects Officer (CEFO) is responsible for this process.

The CEFO commands all the weapons and weapons systems in the force. These assets are the CEFOs to use in the most effective way to carry out the intent of the commander.

The CEFO relies heavily upon decision support systems to help carry out effects tasks. The CEFO ensures all targets are prioritized and duly targeted, coordinates all fire support requests, and matches the target with the most appropriate weapon. In some cases, CEFO will have to hold back some weapons, husband assets, to prevent too many weapons from being fired at one target or weapons usage rate from being too high. CEFO must ensure the deconfliction system is running properly and resolve any problems the decision support system can not handle. Besides the kinetic weapons, CEFO is responsible for non-lethal weapons, to include offensive IW. The CEFO commands all platforms that are solely dedicated to the effects process (such as Unmanned Combat Aerial Vehicles (UCAVs)) and has control over the weapons on multi-mission platforms. Working on each platform for the CEFO is an Effects Officer (EFO).

It is important to note that the effects function is arguably the most centralized process. Almost all the engagement deconfliction decisions, as well as, determining what platform will fire, will need to be made by an automated decision support system (as programmed by the CEFO, based on the intent of the commander), and then broadcast on the network. This becomes a centralized process, with decentralized execution. Firing of weapons can be done remotely by the CEFO or by any EFO.

Effects is separate from OPS, as the effects process is focused on the weapons and their effects and the employment of these weapons. OPS, as described below, focuses on the total force and the proper balance between the CKO, CRO, and CEFO.

5. Chief Operating Officer (COO)/Operations (OPS)

Operations (OPS), commanded by the Chief Operating Officer (COO), is where the day to day execution of the force is carried out.

The COO directs the tactical execution of the force, to include stationing of units which are not under the command of the CKO, CRO or CEFO. These include multi-mission platforms performing several competing functions at once. In the case of one platform performing several functions, the COO takes the potentially competing recommendations of the CKO, CRO, and CEFO and decides the positioning of the force's platforms for the effective positioning of sensor, weapons, and logistics assets.

Other functions of the COO include future force employment, the near real time planning and execution functions, force protection, simulation and event reconstruction analysis. On each platform is an Operations Officer (OPS) who works for the COO.

C. RELATIONSHIPS IN THE ORGANIZATION

In a platform centric view, each platform brought its weapons to the battle and each platform was considered as a whole. Under NCW, this changes. Now each individual sensor and weapon (not platform) will be considered individually and how it (not the platform) can contribute to the force. Weapons, and the control of each weapon, can be distributed throughout the force. This new perspective changes the relationships in the organization, and allows for capability tasking vice unit tasking.

1.   Interaction of the Commanders

The commanders (CKO, CRO, CEFO, COO) must work closely together and keep the success of the force, not just their respective functions, at the forefront when carrying out a mission. A commander who is not concerned about the entire force, will do more harm than good. We are trying to fight the force as a whole and effectively use the capabilities brought to the battle in a distributed fashion.

While each command function has its own unique responsibilities, it is working for the force commander and towards the commander's overall goal. CKO and COO have the most responsibility, while the CRO and CEFO functions are clearer and have less ambiguous solutions. COO makes many decisions on behalf of the commander (i.e. force positioning of multi-mission assets), however, if one of the other functions has very strong objections to the decision of the COO, they may take their case directly to the force commander for arbitration.

In the case of a multi-mission platform, such as a ship, where the CKO is commanding the radar systems, the CEFO is commanding the weapons, the CRO is commanding the resources, and the COO is carrying out the mission, there will likely be instances where not everyone can agree. Hopefully, due to the commanders self-synchronizing their efforts, these instances will be rare, but when they do occur, the force commander will need to step in and allocate the asset's resources. Allocation of assets is one of the roles of the commander, so if the CKO, CRO, CEFO, and COO can not agree, the force commander will make the ultimate decision.

2. Platform Commanders

So if the force commander, CKO, CRO, CEFO, and COO are commanding the force, where does this leave the traditional platform commander? The platform commander is concerned about "manning, training, and equipping" the platform. The platform commander (e.g. a ship's commanding officer) still has command of the platform and is still responsible for safe navigation and safety of the crew, but now the platform commander brings the platform to the battle, then enables other people, either on board or remotely, to use all the assets on the ship. The platform commander must make sure all systems are operating properly so they can be used in the most effective manner across the force.

On each platform the KO, RO, EFO, and OPS are working for the chief of each function (the CKO, CRO, CEFO, COO), see Figure 4-2, but the platform commander will still be involved in each process to ensure the most effective employment of the platform in each functional area.
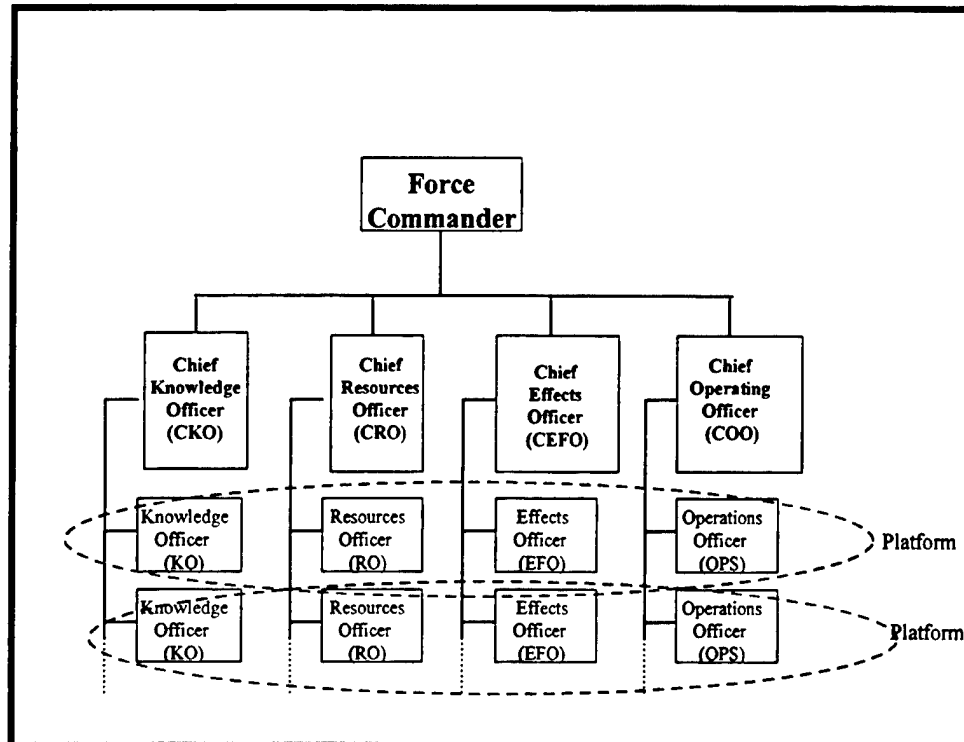
Figure 4-2. Organizational Relationships.

Important to point out is the one situation where the platform centric view still holds true: self-defense of the platform. The platform commander (ship's commanding officer) can override the CKO, CRO, CEFO, or COO if the platform must respond immediately to ensure its survivability. An exception to this maybe when the force commander decides that a platform may have to take a hit to protect another more important asset.

D.   MISSION COMMANDERS (MC)

The addition of mission commanders (MC), see Figure 4-3, makes the proposed organization flexible and adaptable.
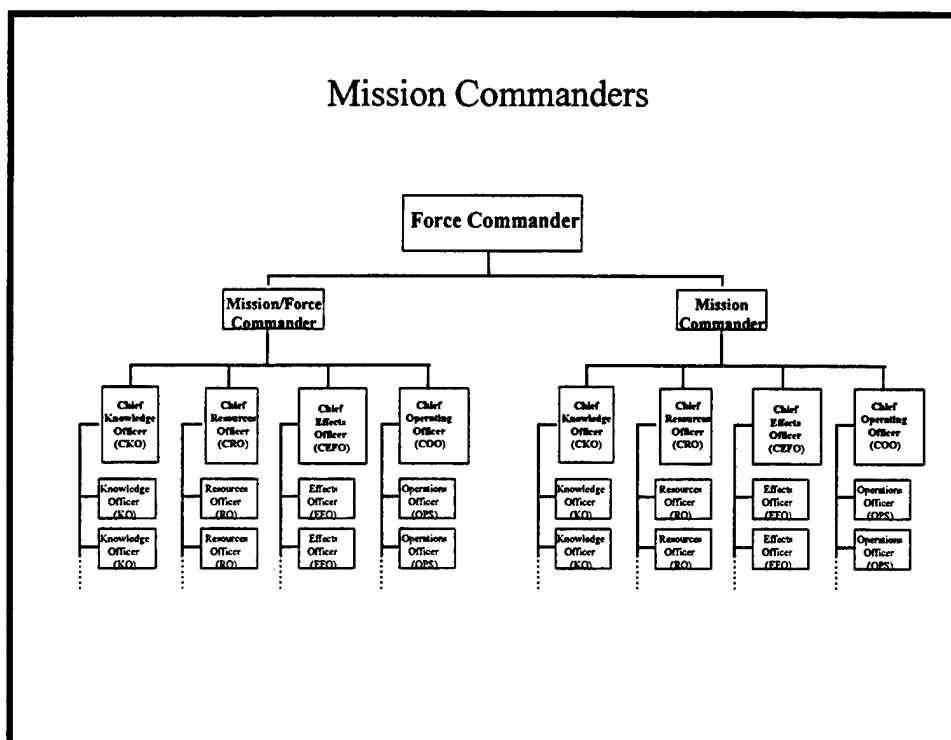
Figure 4-3. Mission Commanders.

In Figure 4-3, the new MC is a section of the old force which has been "spun off" for a specific mission. In a sense, the force commander moves up a level and also functions as a MC for the original force (reporting to him/herself), while the new MC reports to the force commander.

Mission commanders can be activated in several situations. A mission commander can be activated when: the complexity of a mission is high and requires special focus, the mission requires a unique capability, to prevent overload of the functional commanders (i.e. span of control is too large to handle), or forces are required to leave the protection afforded by mutual protection of forces close together.

The assets, both platforms, sensors, and weapons, assigned to the mission are organized around the mission they are assigned. Any asset can be assigned to a mission

commander. It all depends on the mission and the best solution to the problem. The assets assigned are dedicated to the mission commander and for accomplishing the mission.

The Mission Commander concept is designed to give the MC the forces needed to complete the sub task or mission, let the MC organize these forces, plan and execute the mission, and then return main force where the MC and the assigned forces revert to their previous roles (or new roles).

While being adaptable to any situation, standing up a mission commander will not generate unfamiliar command relationships. The newly formed mission commander will also have a CKO, a CRO, a CEFO, and a COO, and each platform will have a KO, a RO, a EFO, and an OPS. Ideally, the people carrying out these roles on the platforms will not change, only the focus of their efforts (the new mission) will change.

The mission commander's organization may be comprised of forces that are not familiar with each other, although it is best if they have worked and trained together. However, the functions (SA, EFF, LOG and OPS) are still the same as before the activation of the mission commander and relationships between force assets assigned to the mission commander are the same as when they were working for the force commander.

Experiments carried out under the Adaptive Architectures for Command and Control (A2C2) program support the idea of an organization focused on a specific task. Previous research found that organizations had a higher level of performance if there was a match between the task, the environment, and the organizational design (Kemple, 1998,

p. 5). Also, in highly uncertain and highly dynamic environments, an organization that can adapt is favorable (Bowditch, 1997, p. 280).

E. THE PROCESS OF SELF-SYNCHRONIZATION

The following helps to examine the process of self-synchronization which an organization might use. Five KOs, on different platforms, are working to build the enhanced situational awareness upon which the force is relying. They are updating the CIP, monitoring systems that update the CIP, and monitoring the sensor assets which they control. The CKO is monitoring the KOs compliance with the CKO intent, which is itself based on the force commander's intent. All the KOs are communicating with each other using the information grid. The KOs are equal in authority as there is no hierarchy amongst the KOs. As one KO sees an opportunity which can be exploited, he/she either takes action, using assets under the KO's control, or alerts another KO of the opportunity. If there are disagreements amongst the KOs, or the CKO sees an opportunity which has not been seen, the CKO will direct one of the KOs to take action.

While the CKO and the KOs are working on building the situational awareness, the CEFO and the EFOs are working on having the right assets (weapons) ready for any action which may be pending. The EFOs ensure that the weapons and weapons systems under their control are ready for combat and disposed so the offensive capabilities of the force are in the most effective position. In the same way there is no hierarchy amongst the KOs, there is none for the EFOs. Any disagreements amongst the EFOs, of which

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should be few as decision support systems should tell the EFOs where to position the weapons for maximum coverage and effects, will be resolved by the CEFO.

If there are disagreements between the KO and EFO of a particular multi-mission capable platform and both missions are being performed simultaneously (e.g. providing both sensor coverage and weapons coverage), then the OPS on each platform, working with the COO, will resolve the conflict. The CKO and CEFO must remember that the "big" picture is what matters. Some give and take between all individuals is vital as resources will always be in short supply. If the issue can not resolved locally, and the CKO, CEFO, and COO can not work together to solve the problem, the force commander must make the ultimate decision regarding asset allocation and utilization.

In matters regarding the logistics function, the RO and CRO function in the same manner as the other functions.

F. PLANNING AND EXECUTION PROCESSES

Although this organization is designed to function as one cohesive unit, there are two distinct processes occurring within the NCW organization at the same time; one is the planning process and the other is the execution process.

The planning process is highly centralized. The force commander and his staff will generate the commander's intent and decide how to allocate resources. The individual KO, RO, EFO, and OPS have little, if any, input into this process. It is very centralized.

On the other hand, the execution process is very de-centralized. It is capitalizing on forces self-synchronizing their efforts to carry out the commanders intent. The force commander is not heavily involved in this process, except to monitor events, ensure that they meet the intent, and resolve any disputes. This is a very de-centralized process.

Obviously there are not two distinct NCW organizations. Unity of command as well as unity of effort are required to carry out the mission. However, the two process (planning and execution) are so distinct that they are examined as different processes in Organizational Consultant.

V. CONTINGENCY THEORY AND THE ORGANIZATIONAL CONSULTANT EXPERT SYSTEM

A. CONTINGENCY THEORY

Organizational theory focuses on the understanding of organizations. It is a multidisciplinary science with distinct viewpoints. Contingency theory is a dominant theme in organization theory. Contingency theory suggests that the effectiveness, efficiency, profitability, and viability of an organizational design is contingent or dependent upon such factors as size, strategy, technology, environment, and managerial preferences (Baligh, 1996, p. 1650).

Figure 5-1 presents the contingency theory-organizational design model pictorially (Burton, 1998, p. 16).
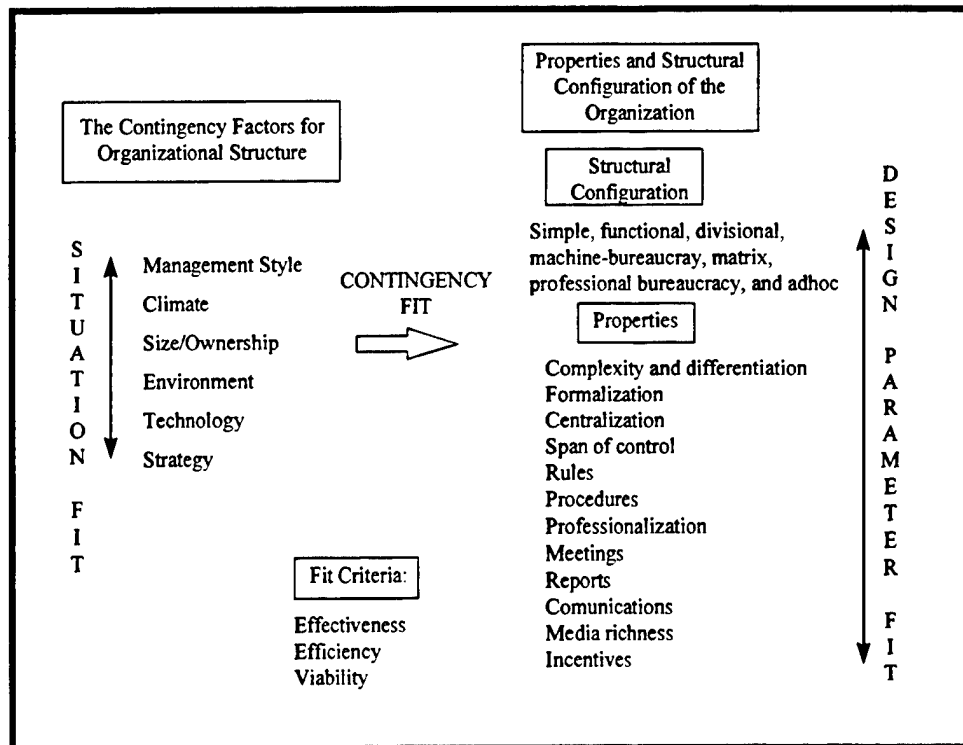
Figure 5-1. Contingency Theory - Organizational Design Model

This model is the basis for the knowledge base in the Organizational Consultant expert system. The knowledge base is derived from the vast contingency theory literature. It is used in a series of "if-then" rules to ensure proper fit Between the contingency factors (the "if" part) and the properties and structural configuration of the organization (the "then" part). Organizational Consultant uses these "if-then" rules according to a particular logical process to produce recommendations on the design of an organization. The designed structure is examined for the fit between its parts and its environment and also the fit between it and the existing structure.

1. Fit Criteria

The organizational structure must be appropriate for the situation (or situations) it will operate in and the organization must also function well as a whole. The term used for describe these two conditions is "fit" (Baligh, 1996, p. 1653). Fit must be achieved in the environment and also within the organization.

An effective and efficient organizational design needs to have a proper fit simultaneously throughout all the dimensions of Figure 5-1. There has to be a fit among the contingency factors themselves (Management style, Climate, Size/Ownership, Environment, technology, and strategy). This is called situational fit. There has to be a fit between the contingency factors, listed on the left side of Figure 5-1, and the design parameters on the right side of the figure. This is called contingency fit. There also has to be a fit among the design parameters - called design parameter fit (Baligh, 1996, p. 1650). The final type of fit, total design, is the most demanding of all. It assumes that the contingency fit, situational fit, and the design parameter fit criteria have all been met (Burton, 1998, p. 18). All four fit criteria are necessary to obtain a useable system.

a. Situation Fit

Situation fit is based on the contingency factors for organizational structure: management style, climate, size/ownership, environment, technology, and strategy. To change any of these contingency factors requires a change to take place in either the environment or the organization. It is difficult to alter the situation fit. For example, one of the contingency factors is technology. For an organization to transition

from a situation where few technology systems being used to where many advanced technology systems are being used requires a great deal of effort and can change the way an organization functions.

Situation fit requires that the design situation be internally consistent. Situational facts, which give answers to the "if" questions, must make sense. For example, an equivocal environment and a routine technology do not fit. There is a recommended design for this situation, and, since it is not being met, it is a situational misfit (Burton, 1998, p 17).

Control of situational misfits (and ensuring they continue to fit in the environment) is key to organizational success. Only those organizations that manage to identify the proper misfits and resolve them will be successful (Burton, 1998, p. 17).

b. Design Parameter Fit

For each design parameter listed on the right hand side of Figure 5-1, the set of if-then propositions that lead to a design recommendation must fit and be in balance. For example, a design recommendation that the organization should be decentralized can be driven by a number of contingencies. Management style, climate, size, environment, technology, and strategy may all strongly suggest decentralization. However, the more likely situation is that there are also design propositions that suggest more centralization. Here the design propositions must be in proper relative balance to obtain a good fit. Certainty factors, discussed below, help obtain proper design parameter fit (Burton, 1998, p. 17).

c.   *Contingency Fit*

Contingency fit is the underlying organizing concept that joins together situation fit and design parameter fit. It explains how situation fit and design parameter fit are based on contingency theory and work together. Contingency fit is labeled as such in Figure 5-1.

Each if-then contingency proposition must be consistent with contingency theory. A rule that states "If the organization is large, then the structure should be centralized" does not fit with what contingency theory tells us and should not be a part of the knowledge base (Burton, 1998, p. 16).

Contingency fit criterion can largely be achieved by adhering to the contingency theory literature and translating this into appropriate if-then statements for the organization (Burton, 1998, p. 17).

d.   *Total Design Fit*

Total fit assumes that situation fit, design parameter fit, and contingency fit are all in balance. Total design fit requires that the design recommendations fit together internally and fit the actual situation (Burton, 1998, p. 18). Total design fit is the reality check - it asks "can the recommendations be used in real life?"

Even with a situational fit and a contingency fit, design parameter fit may not be present. This is due to the fact that each contingency relationship may lead to more than one design recommendation. The right set or combination has to be chosen to

obtain total design fit. Total design fit may be impossible to obtain if a serious situational misfit exists (Burton, 1998, p. 18).

B.   ORGANIZATIONAL CONSULTANT EXPERT SYSTEM

Organizational Consultant is an expert system which relies on a knowledge base derived from a combined large body of literature on organizational theory and a body of expertise on organizational design. Its purpose is to help design organizations. Its underlying assumption is that an organizations primary role is an information processing one.

Contingency theory and the "fit" criteria are the organizing concepts for the creation and development of the knowledge base used by Organizational Consultant. The knowledge base appears as a system of decision rules, or rules that generally apply under specific sets of circumstances.

The knowledge base has over 450 rules. An example of a rule is proposition 5.12: "If the organization is large, then formalization should be high (cf 20)." The cf stands for certainty factor and can range from -100 to 100. The certainty factor measures the degree of belief (or disbelief for negative certainty factors) one has in the rule statement. These certainty factors are set in Organizational Consultant by the developers as default values based on their experience and cumulative research. These certainty factors where not modified by the author. Certainty factors are also used in the input by the user to answer the questions posed by Organizational Consultant and in the recommendations provided

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after the system has analyzed the organization. This will be covered in more detail in Chapter VI.

The problem of organizational design is difficult when one considers the many different variables and combinations possible. For example, an organization can be defined as to whether it is centralized or not, formalized or not, and whether it has a simple, divisional, functional, or ad hoc configuration. In this situation, there are 2x2x4=16 different possible designs from which to chose. The number of choices grows non-linearly as the number of organizational dimensions grows (Burton, 1995, p. 321). To consider all the possibilities, without the aid of a computer, would be monumental at best. The Organizational Consultant expert system allows the user to examine many different variables and possibilities in a short period of time.

Organizational Consultant analyzes the current organizational structure using many facts related to the functioning of the organization. The structure is then described in terms of configuration and its properties. Based on the input, the system, using the rule set in the knowledge base, recommends the configuration and structural properties that give the best fit for the specified situation. The situation itself is analyzed and possible situational or organizational misfits are given. Finally, the current and prescribed organizational structures are compared, and possible changes are recommended. The system allows the user to change input values and rerun the consultation. This is a way to perform sensitivity analyses (Burton, 1998, p. 31).

More information on Contingency Theory and the Organizational Consultant expert system can be found in the Burton and Obel text, *Strategic Organizational Diagnosis and Design* (1998).

VI. ANALYSIS OF THE ORGANIZATION USING ORGANIZATIONAL CONSULTANT

A. INPUTS TO ORGANIZATIONAL CONSULTANT

Based on user input, Organizational Consultant recommends the structure and its structural properties that give the best result within the specified situation. The situation itself is analyzed and possible situational or organizational misfits are given.

Inputs to Organizational Consultant are separated into twelve sections: current configuration, current complexity, current formalization, current centralization, size, age/ownership, diversity, technology, environment, management profile, strategy factors, and climate factors.

Some of the answers to the questions posed by Organizational Consultant can be very subjective. For example, in the current centralization section, the question, "How much discretion does the typical middle manager have over hiring and firing personnel?", has as possible answers "no answer, very great, great, some, little, or none." What is the difference between some and little? The answer is very subjective. Given the same situation, one person may answer differently than another. "No answer" is always an answer if the question is not applicable.

Confidence factors (0 to 100) are included as an input for each question to measure how sure the user of Organizational Consultant is in the answers to each question. A high confidence factor (i.e. 100) means that the user is positive in the value of the answer and Organizational Consultant will fully weigh the propositions associated

with that question. A lower confidence factor will not weigh the associated propositions as strongly.

When answering the questions for the proposed organization, several assumptions were made by the author. There was a realistic progression of the Navy as it moved into the proposed structure. There were no real radical changes in the basic Navy way of life: there are still Officers and Enlisted personnel, salary is set on a chart as it is today, bonuses are paid to some people and not to others, promotions are determined by a selection board (for officers) and a multiple score primarily determines advancement for enlisted personnel, fitness reports and evaluations were still used. Forces are still commanded by a commander responsible overall for the operation and accountable for the forces actions. The Chief Executive of the organization is the Force Commander. Top Management consists of the Force Commander and the other commanders (CKO, CRO, CEFO, COO). Middle management are the KO, RO, EFO, OPS and platform commanders.

Organizational Consultant expert system is designed to look at the entire organization. It can not consider adaptation of the organization or different processes within the organization. NCW has two distinct processes, planning and execution. The planning process is highly centralized, where the force commander is deciding on the intent and the overall strategy for the forces. In the execution process, the commander has delivered the intent and has stepped back to allow the forces to self-synchronize their actions. Here centralization is very low.

These two different "snapshots" of NCW organization, planning and execution, were used to answer the questions posed by Organization Consultant. Each of the two snapshots had a slightly different output from Organizational Consultant.

The author will briefly review each input category and discuss the rational behind the input of each section, both from a planning and execution point of view. Answers to each question can be found in Appendix A along with the authors reasoning for each question.

1. Current Configuration

Configuration specifies the way an organization divides work, breaks tasks into subtasks, and coordinates these activities. An organization can be described as simple, functional, divisional, a machine bureaucracy, professional bureaucracy, adhocracy, or matrix configuration.

This organization has elements of the following four configurations: functional, divisional, simple, and ad hoc.

The functional configuration has unit grouping by functional specialization (production, marketing, finance, human resources, and so on) (ORGCON, 1998). The NCW organization is broken down into functional groups: Situational Awareness (SA), Operations (OPS), Logistics (LOG), and Effects (EFF). Each of these groups, which cross all platforms (divisional configuration), allows the organization to interact within each functional area.

A divisional configuration has self-contained, somewhat autonomous units, coordinated by a headquarters unit (product, customer, or geographical grouping

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including multinational) (ORGCON, 1998). In this configuration each platform is clearly a separate division, operating very autonomously (yet synchronizing with other divisions).

The simple configuration has a flat hierarchy and a singular head for control and decision making. This is a "one man show." (ORGCON, 1998) For the NCW organization the force commander clearly is in charge of the planning process. On the execution side, the "chiefs" of each functional division are in charge of their own simple (flat) organization, as they are in charge of the officers on each platform within their functional area.

The ad hoc configuration is characterized by high horizontal differentiation, low vertical differentiation, low formalization, decentralization, and great flexibility and responsiveness. (ORGCON, 1998) Under this configuration, forces are self-synchronizing. Forces come together with a common purpose (a mission which is clarified by the commander's intent), yet they are not directed how to carry it out. The ad hoc body must decide among themselves how to proceed. This is the heart of self-synchronization accomplished during the execution of a mission.

Although there are elements of each of the four configurations in the organization, a simple configuration captures the essence of the NCW organization during the planning process while an ad hoc configuration describes the execution process.

2. Current Complexity

Complexity is a measure of horizontal (specialization within the organization), vertical (depth of the organization hierarchy), and spatial (amount of geographic

dispersion of the organization) differentiation. As the degree of complexity increases, the need for coordination and the requirement for organizational information processing increases (Burton, 1998, p. 69). Complexity for the NCW organization is characterized by 2 levels, 16 to 30 geographic locations and a moderate number of job titles.

3. Current Formalization

Formalization is the degree to which jobs and procedures within the organization are standardized, rule based, and in writing (Burton, 1998, p. 73). The greater the number of written rules and procedures the higher the formalization. In most studies, the measurement of formalization has been related to written rules (Burton, 1998, p. 73). For the NCW organization (being a military organization) written job descriptions are available for all employees. The planning process has loose compliance with standards as the process is carried out higher in the organization (closer to the force commander who can easily change the standards). The execution process demands more compliance with standards and is supervised closer.

4. Current Centralization

Centralization is the degree to which formal authority to make discretionary choices is concentrated in an individual, unit, or level (usually high in the organization). Centralization is measured by how much direct involvement top managers have in gathering and interpreting the information used in decision making and the degree to which top management directly controls the execution of a decision (Burton, 1998, p. 75). For the NCW organization, top management is greatly involved with the gathering and interpreting of information during the planning process and not directly involved in

execution of these decisions. The typical middle manager has little control over establishing budget (usually set by outside authority), little discretion over how his or her unit will be evaluated, some discretion over hiring and firing personnel, and little discretion over rewards (salary and promotions).

5. Size

Size is one of the variables that influences the choice of an organizational structure. Size is used here as a measure of the information processing capacity. A larger organization requires greater information processing capacity (Burton, 1998, p. 153). An organization of over 2,000 is considered large by Organizational Consultant. Here the author assumes a large organization with 3,000 people.

6. Age / Ownership

Age of the NCW organization can be young, mature or old. The age of the NCW organization is young due to the relatively short tour lengths of military personnel, constant turnover, as well as the dynamic nature of individual units rotating within Joint Task Forces of today. Ownership of the NCW organization is public/state owned.

7. Diversity

Diversity is a measurement of the number of different products that the organization produces, the number of markets the organization competes in and the number of markets overseas. The NCW organization is considered to have "many" different products (products are considered to be different weapons types and different kinds of forces) and compete in "some" different markets. The question concerning

overseas markets was not answered as naval forces always operate overseas during conflicts.

8. Technology

Technology is the information, equipment, techniques, and processes required to transform inputs into outputs (Burton, 1998, p 213). The technology required to carry out the NCW organization is considered to be highly advanced. The major activity of the NCW organization is production - providing energy (via a weapon's effect), at a given location, at a given time. The planning process has both routine (easy to analyze problems and few exceptions) and non-routine (difficult to resolve problems and many exceptions) technology. The execution process has primarily non-routine technology.

9. Environment

The environment can be described as simple or complex, by the amount of uncertainty in the environment, the amount of equivocality in the environment, and rating the toughness of the competition. For the NCW organization (both planning and execution) the environment is complex, uncertainty is high, and the competition is extreme. The equivocality of the planning process is higher than the execution process, as the force commander is trying to determine what course of action to follow, often without knowing specific adversary or engagement locations and intentions.

10. Management Profile

Management profile is concerned with the question of whether management or leadership style affect the choice and fit of the organizational structure. The Organizational Consultant questions in this section concern types of decisions made by

top management, the level of information used to make these decisions, a proactive or reactive approach to taking action, and the top management's attitude towards risk. The NCW organization is characterized by top management making policy and general decisions, long term decisions, being risk neutral, and taking proactive actions. During the planning process top management will use very detailed information to make decisions, while during the execution process only aggregate information as they will not be heavily involved in the execution process.

11. Strategy Factors

Strategy is the determination of the basic long term goals of an organization, the adoption of courses of action and the allocation of resources necessary for carrying out these goals (Burton, 1998, p. 248). The NCW organization was characterized as having a high capital requirement, medium product innovation, medium process innovation, and high concern for quality.

12. Climate Factors

The organizational climate refers to the beliefs and attitudes held by individuals about their organization. The climate is a relatively enduring quality of an organization that is experienced by employees and also influences their behavior (Burton, 1998, p. 113). Climate questions were answered in the best possible, yet still realistic, manner, indicating high trust, medium conflict within the organization, high morale, a moderately equitable rewards system, high leadership credibility and low scapegoating.

B.   RESULTS FROM ORGANIZATIONAL CONSULTANT

Organizational Consultant, as described in Chapter V, uses the knowledge base of over 450 "if-then" statements to analyze the organization. Organizational Consultant also provides written comments about why a particular conclusion was reached.

Recommendations are made with a certainty factor associated with them. In the conclusion, certainty factors may take any value between -100 and +100. The higher the numerical value of the certainty factor, the stronger the conclusion. In general, certainty factors between 0 and 30 indicate a low certainty, 30 to 60 indicate medium certainty, and 60 or above indicates high certainty. Above 80, the recommendation is almost certain.

Sensitivity analysis can also be performed to analyze a questionable result more closely.   Changing the answers to one or two questions can change the results and conclusions of Organizational Consultant. This can provide valuable insights into the organization.

Table 6-1 is a summary of results from Organizational Consultant.

	NCW Organization (Planning)		NCW Organization (Execution)	
SIZE	Large (80)		Large (80)	
CLIMATE	Developmental (76)		Developmental (76)	
MICROINVOLVEMENT	Low (73)		Low (80)	
STRATEGY	Analyzer with innovation (72) Prospector (65)		Prospector (76)	
	Current	Recommended	Current	Recommended
COMPLEXITY	Medium (82)	Low (55) Medium (54)	Medium (82)	Medium (54) High (54) Low (51)
HORIZONTAL DIFF.	Medium (80)	Low (55)	Medium (80)	Low (51) High (51)
VERTICAL DIFF.	Low (80)	Low (79)	Low (80)	Low (59) High (51)
SPATIAL DIFF.	High (80)		High (80)	

CENTRALIZATION	Medium (81)	High (50)	Medium (85)	Low (48)
FORMALIZATION	Medium (76)	Low (71)	High (76)	Low (77)
SPAN OF CONTROL		Moderate (60)		Narrow (58)
MEDIA RICHNESS	High (85) Providing a large amount of information (85)		High (85) Providing a large amount of information (95)	
INCENTIVES	Results (85)		Results (95)	
COORDINATION AND CONTROL	Meetings (86)		Professionalization (100)	
CONFIGURATION	Divisional (69) Matrix (62) Adhocracy (60)		Adhocracy (73) Simple (65)	
SITUATIONAL MISFITS	None		None	
ORGANIZATIONAL MISFITS	Complexity Centralization Formalization Configuration do not match		Complexity Centralization Formalization do not match	
MORE DETAILED RECOMMENDATIONS	1) You may consider decreasing the number of positions for which job descriptions are available. 2) You may give supervisors and middle manager fewer rules and procedures. 3) Managerial employees may be asked to pay less attention to written instructions and procedures. 4) You may consider fewer written job descriptions. 5) Top management may control the execution of decisions more actively. 6) The typical middle manager may be given less discretion over how work exceptions are to be handled.		1) You may consider decreasing the number of positions for which job descriptions are available. 2) You may give supervisors and middle manager fewer rules and procedures. 3) Managerial employees may be asked to pay less attention to written instructions and procedures. 4) You may consider fewer written job descriptions. 5) Middle managers maybe given more discretion over evaluations. 6) The typical middle manager may be given more discretion over personnel rewards. 7) Middle managers may be given more discretion over establishing budgets. 8) The typical middle manager may be given more discretion over establishing a new program or project.	

Table 6-1. Results from Organizational Consultant.

Detailed results from Organizational Consultant are in Appendix B for the planning process for the NCW organization and in Appendix C for the execution process.

Below, each result and the recommendation from Organizational Consultant is discussed. Remarks are taken from the Organizational Consultant results in Appendix B or C.

1. Size

The NCW Organization, for both the planning and execution process, is considered a large organization.

> Based on the answers you provided, it is most likely that your organization's size is large (cf 80). Between 51 and 75 % of the people employed by NCW Organization have a high level of education. Adjustments are made to this effect. The adjusted number of employees is greater than 2,000 and NCW Organization is categorized as large.

2. Climate

The organizational climate is the summary measure of people and behavior. Both the planning and execution processes of the NCW organization have a developmental climate.

> Based on the answers you provided, it is most likely that the organizational climate is a developmental climate (cf 76).

> The developmental climate is characterized as a dynamic, entrepreneurial and creative place to work. People stick their necks out and take risks. The leaders are considered to be innovators and risk takers. The glue that holds organizations together is commitment to experimentation and innovation. The emphasis is on being on the leading edge. Readiness for change and meeting new challenges are important. The organization's long-term emphasis is on growth and acquiring new resources. Success means having unique and new products or services and being a product or service leader is important. The organization encourages individual initiative and freedom.

The rationale behind the recommendation is:

> When the organization has a high to medium level of trust it is likely that the organization has a developmental climate. Employees with a high morale is frequently one element of a developmental climate.

Moderately to high equitable rewards in the organization drives the climate towards a developmental climate. Medium to high leader credibility characterizes an organization with a developmental climate. An organization with a medium level of scapegoating may have a developmental climate.

3. Micro-involvement

Micro-involvement is a leadership characteristic, not an organizational characteristic. The level of management's micro-involvement in decision making is the summary measure of management style. Leaders have a low preference for micro-involvement; managers have a high preference for micro-involvement (ORGCON, 1998).

The NCW Organization management profile, during the planning process, has a low preference for micro-involvement (cf 73). The execution process also has a low preference for micro-involvement, but with a higher confidence factor (cf 80).

Organizational Consultant's reasoning for low micro-involvement by the NCW organization was:

> The management of NCW Organization has a preference for delegating decisions. This will lead toward a low preference for micro-involvement. Management has a long-term horizon when making decisions, which characterizes a preference for a low micro-involvement.
> The management of NCW Organization has a preference for taking actions when making decisions. This will lead toward a low preference for micro-involvement because meeting the problems before they arise allow you to work on the general level and not being consumed with the very detailed decisions that can best be made at lower level in the organization.
> Management has a preference for motivating people and not using control which will lead toward a low preference for micro-involvement.

The execution process had an additional reason for a low level of micro-involvement:

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Since the management has a preference for making decisions on the basis of very aggregate information a low preference for micro-involvement characterization is appropriate.

4. Strategy

The organization's strategy is categorized, following Miles and Snow's (1978) typology, as one of either prospector, analyzer with innovation, analyzer without innovation, defender, or reactor. This is a statement of the current strategy; it is not an analysis of what is the best or preferred strategy for the organization. (ORGCON, 1998)

Organizational Consultant concluded that for the planning process the current strategy is likely an analyzer with innovation strategy (cf 72), however, it could also be a prospector strategy (cf 65). Based on the answers provided for the execution process, the NCW organization's current strategy is likely a prospector strategy (cf 76).

An analyzer with innovation strategy is for an organization that combines the strategy of the prospector and the defender. It moves into the production of a new product or enters a new market after viability has been shown. But in contrast to an analyzer without innovation, it has innovations that run concurrently with the regular production. (ORGCON, 1998)

The prospector strategy is for an organization that continually searches for market opportunities and regularly experiments with potential responses to emerging environmental trends. Thus, the organization is often the creator of change and uncertainty to which it competitors must respond. However, because of its strong concern

for product and market innovation, a prospector is usually not completely efficient. (ORGCON, 1998)

A defender strategy is for an organization that has a narrow product market domain. Top managers in this type of organization are experts in their organization's limited area of operation but do not tend to search outside their domains for new opportunities. As a result of this narrow focus, these organizations seldom need to make major adjustments in their technology, structure, or methods of operation. Instead they devote primary attention to improving the efficiency of their existing operations. (ORGCON, 1998)

Organizational Consultant's reasoning behind an analyzer with innovation strategy for the planning process is:

> For a medium routine technology, NCW Organization has some flexibility. It is consistent with an analyzer with innovation strategy. With a concern for high quality an analyzer with innovation strategy is a likely strategy for NCW Organization.

Organizational Consultant's reasoning for a prospector strategy, for both the planning and execution process is:

> For a prospector strategy to be aggressive in product development or market opportunities exploitation, it requires a high capital investment. NCW Organization has numerous products. A prospector is constantly seeking new product opportunities to serve the existing and potentially new customers. With a concern for high quality a prospector strategy is a likely strategy for NCW Organization. With top management preferring a relatively low level of micro-involvement, the strategy is likely to be prospector.

There was an additional statement for the reasoning behind the conclusion for the execution process:

> A non-routine technology is likely to be costly for NCW Organization, and a prospector strategy of new product development where margins are likely to be high is very reasonable.

The author agrees with the strategy types assigned by Organizational Consultant. The planning process has experts in their respective areas and is concerned with efficiencies (defender strategy). It also searches for new opportunities and wants to be the creator of change, creating uncertainty for the enemy. Also, the planning process will most likely not try out new products until their viability has been shown (analyzer with innovation strategy).

The execution process is looking for new opportunities to exploit, is the creator of change, and desires to create uncertainty for the enemy (prospector strategy).

5. Complexity

Organizational complexity is the combined degree of horizontal, vertical, and spatial differentiation.

The current horizontal differentiation, in both planning and execution, is medium (cf 80). It is recommended to be low (cf 55) for the planning process and either low (cf 51) or high (cf 51) for the execution process.

The current vertical differentiation, in both planning and execution, is low (cf 80) and matches the recommended low level (cf 79 for planning and cf 59 for execution). The execution process could also have a high level of vertical differentiation (cf 51).

Spatial differentiation is high (cf 80) for the NCW organization.

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Organizational Consultant concluded that the current organizational complexity is medium for both the planning and execution processes (cf 82). Organizational consultant is split, with very close confidence factors, for the recommended level of organizational complexity. For the planning process the recommended degree of organizational complexity is low (cf 55), however, it could also be medium (cf 54). For the execution process the recommended degree of organizational complexity is medium (cf 54), high (cf 54) or low (cf 51).

The reasoning behind a low level of complexity is:

> Not much is known about the environment since both the environmental uncertainty and the environmental equivocality of NCW Organization are high. In this situation, the organizational complexity should be low. This allows the organization to adapt quickly. When the environmental hostility of NCW Organization is high, organizational complexity should be low.

The reasoning behind a medium level of complexity is:

> Large public organizations should have medium to high organizational complexity. NCW Organization has a technology that is somewhat routine, which implies that the organizational complexity should be medium. Because NCW Organization has an advanced information system, organizational complexity can be greater than it could otherwise. A developmental climate in the organization requires a medium level of complexity.

Finally, the reasoning behind a high level of complexity, only for the execution process, is:

> NCW Organization has a prospector strategy. Then, the organizational complexity should be either low or high. NCW Organization has a non-routine technology, which implies that the organizational complexity should be high. Top management of NCW Organization has a preference for a low level of micro-involvement, which allows for a higher organizational complexity. Because NCW

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Organization has an advanced information system, organizational complexity can be greater than it could otherwise. Since the size of NCW Organization is large and NCW Organization has a non-routine technology, the complexity should be high - particularly the vertical differentiation.

With such close confidence factors, low (55) and medium (54) for the planning process, and medium (54), high (54) and low (51) for the execution process, the author concludes that a medium level of complexity is probably the best level for the NCW organization. The organization was not designed to be complex, rather it was designed to minimize the number of interactions, and repeat the basic functions (SA, LOG, EFF, OPS) on each platform.

6.   Centralization

Centralization is measured on two main factors: 1) how much involvement top managers have in gathering and interpreting the information they use to make decisions; and 2) the degree to which top management directly controls the execution of the decision.

For both the planning (cf 81) and execution (cf 85) process the current centralization is medium. The recommended levels of centralization are, as expected, high (cf 50) for the planning process and low (cf 48) for execution.

Organizational Consultant's reasoning behind high centralization for the planning process is:

> When there is a high capital requirement and the product innovation is medium, as is the case for NCW Organization, centralization should be rather high to obtain efficiency. When the environment is extremely hostile, top management must take prompt action and centralization must be high. Because NCW Organization has an

advanced information system, centralization can be greater than it could otherwise.

Organizational Consultant's reasoning behind low centralization for the execution process is:

NCW Organization has a prospector strategy. A low centralization is required so that the organization can react and innovate quickly. Large organizations should have low centralization. Since NCW Organization operates in a complex environment and knows only some of the factors that affect the organization and when the values of the factors are relatively unstable, centralization should be low. Low centralization can be allowed when top management has no desire for micro-involvement. A developmental climate in the organization requires a medium to low level of centralization.

These results are expected as the planning process is highly centralized, with the force commander deciding upon the intent. On the other hand, the execution process is very de-centralized with forces self-synchronizing their efforts, based on the commander's intent.

7.   Formalization

Formalization is the degree to which jobs and procedures within the organization are standardized, rule based, and in writing.

The current formalization is medium (cf 76) for the planning process and high (cf 76) for the execution process in the NCW organization.

Organization consultant recommends a low degree of formalization (cf 71) for the planning process:

Since the set of variables in the environment that will be important is not known and since it is not possible to predict what will happen, no efficient rules and procedures can be developed, which implies that NCW Organization's formalization should be low. When environmental hostility is high formalization should be low. Low formalization is consistent with

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top management having a low preference for micro-involvement. A developmental climate in the organization requires a low level of formalization.

Organization consultant also recommends a low degree of formalization (cf 77) for the execution process, but for different reasons:

> NCW Organization has a prospector strategy. A low formalization is required so that the organization can react quickly. Low formalization is also required because of the need for innovations. Organizations with non-routine technology should have low formalization. When environmental hostility is high formalization should be low. Low formalization is consistent with top management having a low preference for micro-involvement. A developmental climate in the organization requires a low level of formalization.

The author agrees that formalization will need to be lowered in the NCW organization. There will still need to be some formalization, to keep reports and interactions standard, however overall formalization in the NCW organization should be low.

8. Span of Control

Due to information networking and force self-synchronization, the author believes that a large (high) span of control could be obtained in the NCW organization.

However, Organizational Consultant recommends that the span of control should be moderate (cf 60) during planning and narrow (cf 58) during execution:

> Since NCW Organization (planning process) has some technology routineness, it should have a moderate span of control.

> and

> Since NCW Organization (execution process) has a non-routine technology, it should have a narrow span of control.

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The underlying factor in determining span of control is the routineness of the technology. Recall that the planning process had "some" technology routiness - both easy to analyze problems and few exceptions (a routine technology) and difficult to resolve problems and many exceptions (non-routine technology) - while the execution process had non-routine technology. Clearly, the level of technology routineness does not capture the concept of self-synchronization.

This may indicate that the large span of control, envisioned by the author, is too difficult. The NCW organization may need more "middle managers" in the organization or more Mission Commanders when the span of control is too great for the force commander. It may also indicate that the CKO, CRO, CEFO, COO will need to do more to allow the force commander a wider span of control.

9. Media Richness

The NCW organization should use media with high media richness (cf 85). The information media that NCW organization uses should provide a large amount of information (planning - cf 85, execution - cf 95).

Large amounts of information will need to be processed in the NCW organization. The right information, with the desired level of detail, must be available to the right person, at the right time, and in the right format for ease of understanding and decision making.

10. Incentives

Incentives should be based on results (planning - cf 85, execution - cf 95).

Results are what matter in warfare. However, it is the results of the entire force, not just one individual or unit grouping, that matter. The needs of the force and its effective utilization must be the driving factor for everyone in the organization.

11. Coordination and Control

Organizational Consultant recommends meetings as the means for coordination and control (cf 86) during the planning process.

> When the environment of NCW Organization has high equivocality, high uncertainty, and high complexity, coordination and control should be obtained through integrators and group meetings. Coordination within each division is very important. Coordination between (among) divisions is usually relegated to top management, which is also concerned about strategic direction and allocation of funds between (among) the divisions. Technology efficiencies can be obtained by sharing technology, information and new developments across divisions. Liaison managers and technology committees are possible coordination mechanisms. Conferences among technical professionals can be very effective. When the organization has a developmental climate, coordination should be obtained using planning, integrators and meetings.

During execution, however, professionalization (cf 100) should be used for coordination and control.

> With a non-routine technology NCW Organization should obtain coordination and control via group meetings. When NCW Organization's environment has medium equivocality, high uncertainty, and high complexity, coordination and control should be obtained through integrators and group meetings. An open organizational climate and team spirit must be fostered. Information must be shared among all levels. Constructive conflict on 'what to do' will be usual. Individual tolerance of ambiguity and uncertainty will be necessary. Individual performance evaluation will be problematic and largely subjective. Mutual adjustments of 'give and take' will be the norm. Frequent informal meetings and temporary task forces will be the primary coordinating devices. When the organization has a developmental climate, coordination should be obtained using planning, integrators and meetings.

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These supportive comments for professionalization are what one would expect for a self-synchronizing force. Professionals are trained to behave in a standardized way. From an information-processing point of view, professionals with skills can process more information than less skilled employees (Burton, 1998, p. 158).

12. Configuration

The most likely configuration for the planning process is be divisional (cf 69), matrix (cf 62) or an adhocracy (cf 60) configuration. For the execution process, the configuration is likely either an adhocracy (cf 73) or simple (cf 65) configuration.

The following is a description of each of the four possible configurations:

> A divisional organization is an organization with self-contained unit grouping into relatively autonomous units coordinated by a headquarters, (product, customer, or geographical grouping).

> A matrix structure is a structure that assigns specialists from functional departments to work on one or more interdisciplinary teams that are led by project leaders. Permanent product teams are also possible. A dual hierarchy manages the same activities and individuals at the same time.

> An adhocracy organization is normally an organization with high horizontal differentiation, low vertical differentiation, low formalization, decentralization, and great flexibility and responsiveness.

> A simple organization has a flat hierarchy and a singular head for control and decision making.

Organizational Consultant's reasoning behind recommending a divisional configuration for the planning process is:

> When the organization is large, the configuration can be a divisional configuration. Because the organization has many products, the configuration should be divisional. The divisionalization of NCW Organization may be based on products or product groups. Because the

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technology is not fully divisible, care should be taken in recommending a divisional configuration.

Organizational Consultant's reasoning behind recommending a matrix configuration for the planning process is:

> When NCW Organization has many products or markets, a matrix configuration is a likely configuration. When NCW Organization's environment has neither low equivocality nor low complexity, the configuration should be matrix. When NCW Organization is large, the configuration can be a matrix configuration. An organization with a developmental climate could have a matrix configuration.

Organizational Consultant's reasoning behind recommending an adhocracy configuration for the planning and execution process is:

> An adhocracy configuration is appropriate when neither the environmental equivocality of NCW Organization nor the environmental uncertainty is low. NCW Organization has many products or many markets which indicates that an adhocracy is an appropriate configuration. When the organization is also young, the conclusion that it should bean adhocracy is further strengthened. Since top management has a low preference for micro-involvement, the ad hoc configuration is feasible. However, the size of the organization is not very important for the choice of an adhocracy configuration.

Finally, Organizational Consultant's reasoning behind recommending a simple configuration for the execution process is:

> The primary reason for recommending a simple configuration is that the organization has extreme environmental hostility. Extreme environmental hostility requires that the organization can respond consistently and rapid to unforeseen challenges. Therefore, it must have a simple configuration. A prospector like NCW Organization can be configured as a simple organization.

Interesting to note is that the anticipated configuration, adhocracy, was recommended for the execution process. An adhocracy is the heart of the self-synchronization process. Forces mutually adjust to each other.

On the other hand, the anticipated configuration for the planning process, a simple configuration, was not recommended. This is due to the fact that there are many products in the planning process of the NCW organization and a divisional configuration is best suited for a production process.

As discussed at the end of Chapter IV, even though there are two distinct processes occurring within the organization, there is still only one NCW organization. Changing between configurations (divisional in the planning process and an adhocracy in the execution process) will be difficult. A mix of both divisional and adhocracy configurations will be required.

C.   MISFITS

Organizational Consultant describes two type of misfits - situational and organizational (design parameter). Situational misfits occur when the design situations are not internally consistent, e.g. Organizational Consultant's recommendations for a highly equivocal environment are not consistent with those for a routine technology. Organizational misfits exist whenever the level of an organization design parameter differs significantly from the level recommended by Organizational Consultant. (Burton, 1998, p 392)

1. Situational Misfits

A situation misfit is an unbalanced situation among the contingency factors of management style, size, environment, technology, climate, and strategy. There are no situation misfits (cf 100).

This indicates that a high level of internal consistency exists, both in the planning and execution processes of the proposed NCW organization, between the contingency factors for organizational structure (strategy, size, ownership, technology, environment, and management preferences). There is a fit between the NCW organization, both in planning and execution, and the multiple contingency factors.

2. Organizational Misfits

While there were no situational misfits, there were organizational misfits in both the planning and execution processes of the NCW organization in the categories complexity, centralization, and formalization. Configuration was also an organizational misfit for the planning process of the NCW organization.

The current organizational complexity was medium for both the planning and execution process. The recommended configurations all had very close confidence factors (low (cf 55) and medium (cf 54) for planning and medium (cf 54), high (cf 54), and low (cf 51) for execution) indicating that any one may be the best configuration. As discussed earlier, it is the authors opinion that a medium level of organizational complexity is best for the NCW organization.

Centralization was recommended to be high during the planning process or low during execution. These results were expected for the NCW organization. What was not expected was centralization to be characterized as medium for the current situation.

Centralization was expected to be high during planning and low during execution for the current situation (as Organizational Consultant recommended). This difference, between current and recommended centralization, caused centralization to be identified as an organizational misfit.

Formalization was recommended to be low in the NCW organization but characterized as either medium (planning) or high (execution) in the current organization. This is an area where the Navy will need to change. Formalization should be low. Due to the anticipated environmental hostility (high), the Navy will need to change the formality of the organization and allow more independent actions, rather than rigid following of procedures and rules. Procedures and rules have their place, but creativity and looking at situations in new ways will become paramount.

The configuration was an organizational misfit only for the planning process. The author characterized the best configuration to be a simple one during the planning process. Organizational Consultant recommended either a divisional, matrix, or adhocracy configuration, hence the misfit.

D. MORE DETAILED RECOMMENDATIONS

Organizational Consultant had a number of additional recommendations for the NCW organization.

Common to both the planning and execution process were four recommendations:

- "You may consider decreasing the number of positions for which job descriptions are available."

- "You may give supervisors and middle managers fewer rules and procedures."

- "Managerial employees may be asked to pay less attention to written instructions and procedures."

- "You may consider fewer written job descriptions."

These recommendations call for less formalization within the NCW organization. This agrees with previous discussions concerning lowering the level of formalization in the NCW organization and the Navy.

There were two additional recommendations for the planning process:

- "Top management may control the execution of decisions more actively."

- "The typical middle manager may be given less discretion over how work exceptions are to be handled."

These recommendations call for more centralization during the planning process, clearly desired in the NCW organization.

There were four more recommendations for the execution process of the NCW organization:

- "Middle managers may be given more discretion over evaluations."

- "The typical middle manager may be given more discretion over personnel rewards."

- "Middle managers may be given more discretion over establishing budgets."

- "The typical middle manager may be given more discretion over establishing a new program or project."

Each of these recommendations calls for empowering the lower levels of the NCW organization during execution.

E.   CONCLUSION

Is the proposed Command and Control structure fit in a NCW environment? Does the organization have a total design fit, where the situation fit, design parameter fit, and contingency fit are all in balance?

The NCW organization fits situationally and with several changes, can fit organizationally as well, thereby obtaining total design fit.   There were no situational misfits and each of the organizational misfits can be resolved for the NCW organization. The NCW organization will need to change in several categories and each change will be good for the NCW organization.   The NCW organization will need to have a medium level of organizational complexity, high centralization during the planning process and low centralization during execution, low formalization throughout the NCW organization, and adopt a different configuration during the planning process.

VII. ISSUES, RECOMMENDATIONS, AND CONCLUSION

A. ISSUES

When adopting a new organization there are major issues to confront. Change is never easy and there is always the inertia of the status quo to overcome. But if one does not think about the impacts and experiment with proposed solutions, total success of the organization will never be achieved. In adopting this new organization there are some major issues to confront.

1. Cultural

Cultural barriers are debatably the hardest ones to overcome. Adopting this new organization will require significant shifts in organizational culture. It calls for new commanders with new responsibilities. This will mean that the traditional roles of a ship's commanding officer will change. Convincing the navy traditionalist that this change is for the better and will result in a stronger, more robust force, will be difficult. A strong case, based on results of experiments and war games, will be required to prove that this organization is effective and efficient in the NCW environment.

2. Trust

Trust is an important issue to consider. Both trust by the force commander in the lower level commanders and sailors, but also trust by the lower level commanders and sailors in the force commander. Forces will not self-synchronize if their actions are being excessively questioned by the commander. Platform commanders will also have to trust

that their protective safety and the effective use of their assets (sensors and weapons) is being accomplished by the functional commanders.

3.   Training

Training forces as a whole, planning operations together, and fighting as one entity, not separate platforms, will be key to the NCW organization's success. Teamwork and understanding the commander's intent will greatly enhance the forces' performance.

Grooming a cadre of personnel capable of performing the overarching functions is necessary. They need to be tracked from the very beginning of their careers with a detailed career path of schools and sequential job assignments. It is the only way that the force will be experienced enough within each functional area to exercise a large span of control.

4.   Joint

This organization is designed for the Navy. What about the Marine Corps, Army, and Air Force? Will the other services be able to operate with the Navy in this structure or will they need to adopt a similar structure to allow coordination amongst the services? Experimentation, both by the Navy and other services, will be required to see if this organization is compatible with the evolving structures of other services.

5.   Coalition

Can we operate with coalition partners in a NCW environment? Will we need to provide them equipment (and money for the capital requirements) so they can be part of the network? Will our speed of command be so fast that we will leave our coalition partners out of the fight? These are major questions which need to be addressed by the

Navy's senior leadership, as NCW is developed, regardless of whether or not the proposed organization is adopted.

B.   RECOMMENDATIONS

1.   Organizational Consultant

The Organizational Consultant expert system, while a useful tool for analyzing organizations, could be improved.

Organizational Consultant is based on research conducted in the civilian world. The military environment is unique. While many of the lessons learned from the civilian world do apply in military situations, there may be some that do not. A military version of Organizational Consultant would be useful.

It was hard for Organizational Consultant to capture the total organization and the adaptability that is envisioned. The flexibility that Mission Commanders provide to the organization and how it can adapt was not fully captured by Organizational Consultant. Organizational Consultant only provides a static snapshot of the organization. The adaptive process and structure of the NCW organization was not fully captured in Organizational Consultant.

Finally, it can be difficult to understand how a change in one input changes the output of Organizational Consultant. The capability to understand, perhaps visualize in a flowchart, the complex interactions analyzed by Organizational Consultant would be helpful.

2. Experiments and War Games

Experiments and war games are the first step to validating this, or any other, new organizational structure. The Navy's new Maritime Battle Center in Newport, Rhode Island, is the place where this organization could be analyzed and explored in depth.

Toward the end of the experimental stage, actual implementation in a Fleet Battle Experiment would either verify the organization's concepts or prove them unfeasible. New organizational structures need to be experimented with by fleet participants.

3. Future Research

There is still much research to be conducted in exploring organizations for the network centric environment. Some possible topics include:

- Are there better organizational structure for NCW?

- What are the details of the process of self-synchronization? How is self-synchronization executed?

- What is the maximum span of control in a network centric environment?

- Which processes can have low formalization and which ones need to remain high?

- What effect does NCW have on coalition partners? Can we operate with them in a network centric world?

C. CONCLUSION

Regardless of whether this organization is adopted for further exploration or not, a fresh look at organizational structures for the NCW environment is useful. This thesis,

and the conclusion that the proposed organization can be made to fit organizationally, is one step in that direction. Brigadier General J.P. Kiszely has stated that "without originality, let alone genius, the new technologies will merely be grafted onto existing organizations and doctrines in a way designed to cause the least inconvenience and least unpleasantness in peacetime. The risks of having operated on this principle in the past are as nothing to the dangers of doing so in the future." (Roman, 1998, p. 2) The United States Navy must find, and adopt, an organizational structure which is efficient and effective for the network centric warfare environment.

APPENDIX A: INPUTS TO ORGANIZATIONAL CONSULTANT

NCW Organization (Planning) inputs are in **bold**. NCW Organization (Execution) inputs are in *italics*. Where the inputs are the same for both planning and execution within the NCW Organization the answers are ***bold and italics***.

Current Configuration

1. **What is the organization's current organizational configuration?**
No answer
Simple
Functional
Divisional
Machine Bureaucracy
Professional Bureaucracy
Adhocracy
Matrix
Other
Certainty Factor: 75
A simple configuration is best for the planning process as the force commander is in charge of the highly centralized process. For the execution process, an adhocracy is the best configuration as an adhocracy captures the essence of self-synchronization best.

Current Complexity

1. **How many different job titles are there?**
No answer
Very few
Small number
Moderate number
Large number
Great number
Certainty Factor: 80

2.   **What proportion of employees hold advanced degrees or have many years of specialized training?**
No answer
0-10%
11-20%
21-50%
51-75%
76-100%
Certainty Factor: 80
All Officers hold advanced degrees and most enlisted personnel have "A" and "C" school experience as well as many years of specialized on the job training.

3.   **How many vertical levels separate the chief executive from those employees working at the bottom of the organization?**
No answer
1 or 2
3 to 5
6 to 8
9 to 12
more than 12
Certainty Factor: 80
In this structure, the Force Commander has the "Chiefs" (CKO, CEFO, CRO, COO) and the KO, RO, EFO, OPS working for him. This is two levels. The author is not counting the levels not involved in the decision making process (i.e. engineers working on a ship).

4.   **What is the average number of vertical levels for the organization?**
No answer
1 or 2
3 to 5
6 to 8
9 to 12
more than 12
Certainty Factor: 80
See question three, above.

5. **Including the main center, how many geographic locations are there where organization members are employed?**

No answer
1 or 2
3 to 5
6 to 15
16 to 30
more than 30
Certainty Factor: 80
This number includes each platform as a separate location.

6. **What is the average distance of these outlying units from the organization's main center?**

No answer
Less than 10 miles
11 to 100 miles
101 to 500 miles
501 to 3500 miles
more than 3500 miles
one site
Certainty Factor: 100
Although forces will be dispersed, they will likely be within 500 miles of each other.

7. **What proportion of the organization's total work force are located at these separate units?**

No answer
Less than 10%
11 to 25%
26 to 60%
61 to 90%
more than 90%
one site
Certainty Factor: 80
Platforms are certainly considered separate units and the platform divisions will separate units.

Current Formalization

1.   Written job descriptions available for?
No answer
none
operating employees or top management
operating employees and first line supervisors
operating employees, lower and middle management
all employees, excluding senior management
all employees, including senior management
Certainty Factor: 100
Everyone in the military has a job description (although some are much more descriptive, and useful, than others).

2.   Where written job descriptions exist, how closely are employees supervised to ensure compliance with standards set in the job description?
No answer
very loose
loose
moderately close
close
very close
Certainty Factor: 80
The planning process has less compliance with standards as it is carried out higher in the organization (closer to the force commander who can easily change the standard). The execution process has more compliance with standards and is supervised closer to ensure compliance with the standard.

3.   How much latitude are employees allowed from standards?
No answer
a great deal
large amount
a moderate amount
very little
none
Certainty Factor: 80
See number two above.

4.   **What percentage of non-managerial employees are given written operating instructions or procedures for their job?**
No answer
0 to 20%
21 to 40%
41 to 60%
61 to 80%
more than 80%
Certainty Factor: 60
Most non-managerial jobs have written procedures (i.e. how to operate a radar), while managers (leaders) have very few written procedures.

5.   **Of those managerial employees given written instructions or procedures, to what extent are they followed?**
No answer
none
little
some
a great deal
a very great deal
no written instructions
Certainty Factor: 75
Given instructions, military personnel will carry them out to the best of their ability.

6.   **To what extent are supervisors and middle managers free from rules, procedures, and policies when they make decisions?**
No answer
a very great deal
a great deal
some
little
none
Certainty Factor: 80
Supervisors and middle managers rarely deviate; they will carry out the intent of the commander.

7. **What percentage of all the rules and procedures that exist within the organization is in writing?**
No answer
0 to 20%
21 to 40%
41 to 60%
61 to 80%
more than 80%
Certainty Factor: 60
Most procedures for routine evolutions (i.e. radar scope operation, checklists for ship procedures, etc.) or emergencies (i.e. fire in equipment) are written, while non-routine operational procedures are not written (which is why they are non-routine).

Current Centralization

1. **How much direct involvement does top management have in gathering the information they will use in making decisions?**
No answer
none
little
some
a great deal
a very great deal
Certainty Factor: 80
The top management (force commander and his staff), while not gathering the information themselves, will certainly tell subordinates what information is required for the planning process. The questions does not apply for the execution of decisions.

2. **To what degree does top management participate in the interpretation of the information input?**
No answer
0 to 20%
21 to 40%
41 to 60%
61 to 80%
more than 80%
Certainty Factor: 80
The force commander will certainly want to examine the information gathered for the planning process. The question does not apply for the execution process.

3. **To what degree does top management directly control execution of a decision?**
No answer
0 to 20%
21 to 40%
41 to 60%
61 to 80%
more than 80%
Certainty Factor: 80
The commander will direct his forces to execute his intent, but he will not control their actions unless it is in conflict with his intent.

4. **How much discretion does the typical middle manager have over establishing his or her budget?**
No answer
very great
great
some
little
none
Certainty Factor: 80
Budget is usually set by outside authority.

5. **How much discretion does the typical middle manager have over determining how his or her unit will be evaluated?**
No answer
very great
great
some
little
none
Certainty Factor: 90
The middle manager (unit commander) will forward a evaluation input (whether it is the unit commander's fitness report or an award for the unit) to the commander but the evaluation decision will be made by the force commander.

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6. **How much discretion does the typical middle manager have over hiring and firing personnel?**

No answer

very great

great

some

little

Certainty Factor: 80

The middle manager has little input on who will be sent to his unit. The middle manger has more discretion over firing personnel, but this takes great effort and must be documented and justified. Therefore, the answer to the question is some.

7. **How much discretion does the typical middle manager have over personnel rewards (i.e. salary increases and promotions)?**

No answer

very great

great

some

little

Certainty Factor: 90

Salary is set, promotions are determined by outside forces (selection boards or examination scores). The middle manager can promote a few individuals a year (via the Command Advancement Program) and can hand out awards which contribute points towards advancement scores or are looked a positively on an advancement board.

8. **How much discretion does the typical middle manager have over purchasing equipment and supplies?**

No answer

very great

great

some

little

Certainty Factor: 80

The middle manager has great latitude over consumable supplies, but little control over larger purchases (i.e. weapon systems).

9.   **How much discretion does the typical middle manager have over establishing a new project or program?**
No answer
very great
great
some
little
none
Certainty Factor: 80
Given the commanders intent, the middle manager has little discretion (However, there is large discretion on how to achieve that intent).

10.   **How much discretion does the typical middle manager have over how work exceptions are to be handled?**
No answer
very great
great
some
little
none
Certainty Factor: 70
Once the commander's intent is promulgated, the "chiefs" are tasked with carrying it out and do not need to be controlled by the commander.

Size

1.   **How many employees does this organization have?**
Input any number: 3,000
Certainty Factor: 80
This number, since the NCW organization is large, is not really important as Organizational Consultant will treat any number over 2,000 (when adjusted due to the professionalism score) as large (Burton, 1998, p. 153).

Age/Ownership

1.   How old is the organization?
No answer
young
mature
old
Certainty Factor: 90
The Force (a Joint Task Force of today) comes together for a specific mission and then dissolves.

2.   What kind of ownership does the organization have?
No answer
private
incorporated
public/state owned
subsidiary
Certainty Factor: 75
the military is a public institution.

Diversity

1.   Does the organization have many different products?
No answer
many
some
few
Certainty Factor: 80
Products are considered to be different weapon types and different kinds of forces.

2.   Does the organization operate in many different markets?
No answer
many
some
few
Certainty Factor: 80
Each location could be considered a different market or the collection of many different locations could be considered one market.

3. **Does the organization operate in more than one country? If yes, is the activity level abroad greater than 25%?**

No answer

Yes - activity level greater than 25%

Yes - activity level lower than 25%

no

Certainty Factor: 80

This question is not applicable as the entire area of operations could be in one country or encompass several countries. The entire operation is abroad.

4. **Does the organization have many different products in the foreign market?**

No answer

many

some

few

Certainty Factor: 80

See number three above.

Technology

1. **What is the major activity of the organization?**

No answer

production

service

retail

wholesale

Certainty Factor: 60

One could argue that the military is providing a service to the country (either the United States or the victim of belligerent action), however production for the military is viewed as providing energy at a given location at a given time. Hence, production is a more applicable answer.

2. **What kind of technology does the organization have?**

No answer

a standard high volume retail

a high automated retail

a specialized customer oriented retail

Certainty Factor: 100

The technology is not retail.

3. **Does the organization have a routine technology?**
No answer
no
some
yes
Certainty Factor: 90
The planning process has both easy-to-analyze problems and few exceptions (routine technology) and also difficult-to-resolve problems and many exceptions (non-routine technology). The execution process has more difficult to resolve problems and many exceptions (non-routine technology).

4. **Is the technology divisible?**
No answer
highly
somewhat
little
Certainty Factor: 80
Some tasks can be broken-down into smaller task, while others can not.

5. **Does the organization have a strong or weak dominant technology?**
No answer
weak
average
strong
Certainty Factor: 80
No one technology dominates the force (although it is highly reliant on networks, connectivity, and decision support systems).

6. **Does the organization use or plan to use an advanced information system?**
No answer
yes
no
Certainty Factor: 100
Network Centric Warfare relies heavily on advanced information systems.

Environment

1.   **Is the organizational environment simple or complex?**
No answer
simple
some
complex
Certainty Factor: 100
The environment will certainly be complex.

2.   **What is the level of uncertainty of the environment?**
No answer
low
medium
high
Certainty Factor: 100
Uncertainly will be high - we will try to stay ahead of the adversary but military operations are always uncertain.

3.   **Is the equivocality of the environment low or high?**
No answer
low
medium
high
Certainty Factor: 75
Equivocality means ambiguity in the existence of multiple and conflicting interpretations of the organizational situation. High equivocality means confusion and lack of understanding. Equivocality means that asking a yes/no question is not feasible. You are not certain about which questions to ask about the environment and if a question is posed, the situation is ill defined to the point where a clear answer will not be forthcoming. You may not know where the problems are. On the planning side the equivocality is high, while during execution it will be medium since the planning process has removed some of the equivocality.

4.   **Is the organizational environment hostile - how tough is the competition?**
No answer
extreme
high
medium
low
Certainty Factor: 80
The competition is always assumed to be very hostile.

Management Profile

1.   **Top management may prefer to make most of the decisions themselves; or they may prefer to delegate numerous decisions to other managers i.e.;, greater preference for decentralization. What kind of decisions does top management prefer to make?**
No answer
policy and general decisions
both general and some operating decisions
both general and operating decisions
Certainty Factor: 90
The commander will promulgate his intent and then step back and observe.

2.   **Top management may prefer to make long-term decision or short-time decision. What kind of decisions does top management prefer to make?**
No answer
long term
long term and short time
short time
Certainty Factor: 80
The commander will decide the long term objectives (i.e. how the end the conflict) and what strategy to use in his intent.

3.   **Top management may prefer to use very detailed or very aggregate information when making decisions. What level of detail of information does top management prefer to use when making decisions?**
No answer
very detailed information
medium detailed information
very aggregate information
Certainty Factor: 80
During the planning process the commander will want to have as much information as possible. During execution, the commander will rely on more aggregate information.

4.   **Top management may prefer to be proactive in its thinking, anticipate future events and take pre-emptive action. It may be reactive; wait and see and then act. What is management's preference on taking action?**

No answer

proactive anticipating future events

some proactive and some reactive

reactive to events as they occur

Certainty Factor: 80

Top management is more concerned with the planning process and will be looking into the future (proactive).

5.   **Top management may be risk averse in its decision making or it may have a preference to assume risk. What is top management's attitude towards risk?**

No answer

risk propensity

risk neutral

risk adverse

Certainty Factor: 80

Risk is necessary but every step is taken to reduce the risk to our forces.

6.   **Top management may prefer to manage through an ex ante motivation or ex post control techniques. What kind of motivation and control does top management prefer?**

No answer

motivation through inspiration

a combination of motivation and control

using control techniques

Certainty Factor: 75

The commander will hopefully inspire his forces to success without having to control them.

Strategy Factors

1. **Does the organization have a high or low capital requirement?**
No answer
high
medium
low
Certainty Factor: 90
Military equipment and operations are expensive.

2. **Does the organization have high or low product innovation?**
No answer
high
medium
low
Certainty Factor: 70
The force controls the production - providing energy at a given location at a given time. Some proven methods will be used and some innovation will occur.

3. **Does the organization have high or low process innovation?**
No answer
high
medium
low
Certainty Factor: 70
Although forces will rely on proven methods, new methods will also be undertaken.

4. **Does the organization have a high or low concern for quality?**
No answer
high
medium
low
Certainty Factor: 80

5.	**How is the organization's price level compared to its competitors?**
No answer
high
medium
low
Certainty Factor: 100
Price is not a concern of the commander.

Climate Factors

In this section the climate (morale) of the forces is assumed to be good. Questions are answered in a realistic manner with a slant towards a positive climate.

1.	**The level of trust - sharing, openness, trust - is:**
No answer
high
medium
low
Certainty Factor: 80

2.	**The level of conflict - disagreement, friction - in this organization is:**
No answer
high
medium
low
Certainty Factor: 80

3.	**The employee morale - confidence, enthusiasm - in this organization is:**
No answer
high
medium
low
Certainty Factor: 80

4.	**Rewards are given in an equitable fashion:**
No answer
highly equitable
moderately equitable
inequitable
Certainty factor: 80

5. **The organization's resistance to change is:**
No answer
high
medium
low
Certainty Factor: 80

6. **The leadership credibility - respect, inspiration, acceptance - is:**
No answer
high
medium
low
Certainty Factor: 80

7. **The level of scapegoating - shifting of responsibility for actions which fail - is:**
No answer
high
medium
low
Certainty Factor: 80

APPENDIX B: RESULTS FROM ORGANIZATIONAL CONSULTANT (PLANNING PROCESS)

REPORT SUMMARY - NCW Organization

Time: 11:00:21, 11/24/98
Scenario: Planning

INPUT DATA SUMMARY

The description below summarizes and interprets your answers to the questions about your organization and its situation. It states your answers concerning the organization's current configuration, complexity, formalization, and centralization. Your responses to the various questions on the contingencies of age, size, technology, environment, management style, cultural climate and strategy factors are also given. The writeup below summarizes the input data for the analysis.

- NCW Organization has a simple configuration (cf 75).
- NCW Organization has a moderate number of different jobs (cf 80).
- Of the employees at NCW Organization 51 to 75 % have an advanced degree or many years of special training (cf 80).
- NCW Organization has 1 or 2 vertical levels separating top management from the bottom level of the organization (cf 80).
- The mean number of vertical levels is 1 or 2 (cf 80).
- NCW Organization has 16 to 30 separate geographic locations (cf 80).
- NCW Organization's average distance of these separate units from the organization's headquarters is 101 to 500 miles (cf 100).
- 61 to 90 % of NCW Organization's total workforce is located at these separate units (cf 80).
- Job descriptions are available for all employees, including senior management (cf 100).
- Where written job descriptions exist, the employees are supervised loosely to ensure compliance with standards set in the job description (cf 80).
- The employees are allowed to deviate a large amount from the standards (cf 80).
- 81 to 100 % non-managerial employees are given written operating instructions or procedures for their job (cf 60).
- The written instructions or procedures given are followed to a great extent (cf 75).
- Supervisors and middle managers are to a little extent free from rules, procedures, and policies when they make decisions (cf 80).
- 21 to 40 % of all the rules and procedures that exist within the organization are in writing (cf 60).

- Top Management is to a very great extent involved in gathering the information they will use in making decisions (cf 80).
- Top management participates in the interpretation of more than 80 % of the information input (cf 80).
- Top management directly controls 0 to 20 % of the decisions executed (cf 80).
- The typical middle manager has little discretion over establishing his or her budget (cf 80).
- The typical middle manager has little discretion over how his/her unit will be evaluated (cf 90).
- The typical middle manager has some discretion over the hiring and firing of personnel (cf 80).
- The typical middle manager has little discretion over personnel rewards - (ie, salary increases and promotions) (cf 90).
- The typical middle manager has some discretion over purchasing equipment and supplies (cf 80).
- The typical middle manager has little discretion over establishing a new project or program (cf 80).
- The typical middle manager has great discretion over how work exceptions are to be handled (cf 70).
- NCW Organization has 3000 employees (cf 80).
- NCW Organization's age is young (cf 90).
- NCW Organization's ownership status is public (cf 75).
- NCW Organization has many different products (cf 80).
- NCW Organization has some different markets (cf 80).
- NCW Organization has an undertermined level of international activity (cf 100).
- NCW Organization has an undetermined number of different products in the foreign markets (cf 100).
- NCW Organization's major activity is categorized as production (cf 60).
- NCW Organization has an undetermined production technology (cf 100).
- NCW Organization has a medium routine technology (cf 90).
- NCW Organization's technology is somewhat divisible (cf 80).
- NCW Organization's technology dominance is average (cf 80).
- NCW Organization has either planned or already has an advanced information system (cf 100).
- NCW Organization's environment is complex (cf 100).
- The uncertainty of NCW Organization's environment is high (cf 100).
- The equivocality of the organization's environment is high (cf 75).
- NCW Organization's environment is extremely hostile (cf 80).
- Top management prefers to make policy and general resource allocation decisions (cf 90).
- Top management primarily prefers to make long-term decisions (cf 80).
- Top management has a preference for very detailed information when making decisions (cf 80).

- Top management has a preference for proactive actions (cf 80).
- Top management is risk neutral (cf 80).
- Top management has a preference for motivation through inspiration (cf 75).
- NCW Organization operates in an industry with a high capital requirement (cf 90).
- NCW Organization has a medium product innovation (cf 70).
- NCW Organization has a medium process innovation (cf 70).
- NCW Organization has a high concern for quality (cf 80).
- NCW Organization's price level is undetermined relative to its competitors (cf 100).
- The level of trust is high (cf 80).
- The level of conflict is medium (cf 80).
- The employee morale is high (cf 80).
- Rewards are given in a moderately equitably fashion (cf 80).
- The resistance to change is medium (cf 80).
- The leader credibility is high (cf 80).
- The level of scapegoating is low (cf 80).

THE SIZE

The size of the organization - large, medium, or small - is based upon the number of employees, adjusted for their level of education or technical skills.

Based on the answers you provided, it is most likely that your organization's size is large (cf 80).

Between 51 and 75 % of the people employed by NCW Organization have a high level of education. Adjustments are made to this effect. The adjusted number of employees is greater than 2,000 and NCW Organization is categorized as large.

THE CLIMATE

The organizational climate effect is the summary measure of people and behavior.

Based on the answers you provided, it is most likely that the organizational climate is a developmental climate (cf 76).

The developmental climate is characterized as a dynamic, entrepreneurial and creative place to work. People stick their necks out and take risks. The leaders are considered to be innovators and risk takers. The glue that holds organizations together is commitment to experimentation and innovation. The emphasis is on being on the leading edge. Readiness for change and meeting new challenges are important. The organization's long-term emphasis is on growth and acquiring new resources. Success means having unique and new products or services and being a product or service leader is important. The organization encourages individual initiative and freedom.

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When the organization has a high to medium level of trust it is likely that the organization has a developmental climate. Employees with a high morale is frequently one element of a developmental climate. Moderately to high equitable rewards in the organization drives the climate towards a developmental climate. Medium to high leader credibility characterizes an organization with a developmental climate. An organization with a medium level of scapegoating may have a developmental climate.

THE MANAGEMENT STYLE

The level of management's microinvolvement in decision making is the summary measure of management style. Leaders have a low preference for microinvolvement; managers have a high preference for microinvolvement.

Based on the answers you provided, it is most likely that your management profile has a low preference for microinvolvement (cf 73).

The management of NCW Organization has a preference for delegating decisions. This will lead toward a low preference for microinvolvement. Management has a long-term horizon when making decisions, which characterizes a preference for a low microinvolvement. The management of NCW Organization has a preference for taking actions when making decisions. This will lead toward a low preference for microinvolvement because meeting the problems before they arise allow you to work on the general level and not being consumed with the very detailed decisions that can best be made at lower level in the organization. Management has a preference for motivating people and not using control which will lead toward a low preference for microinvolvement.

THE STRATEGY

The organization's strategy is categorized as one of either prospector, analyzer with innovation, analyzer without innovation, defender, or reactor. These categories follow Miles and Snow's typology. Based on your answers, the organization has been assigned to a strategy category. This is a statement of the current strategy; it is not an analysis of what is the best or preferred strategy for the organization.

Based on the answers you provided, it is most likely that your organization's strategy is an analyzer with innovation strategy (cf 72).

It could also be: a prospector (cf 65).

An organization with an analyzer with innovation strategy is an organization that combines the strategy of the defender and the prospector. It moves into the production of a new product or enters a new market after viability has been shown. But in contrast to an

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analyzer without innovation, it has innovations that run concurrently with the regular production. It has a dual technology core.

For a medium routine technology, NCW Organization has some flexibility. It is consistent with an analyzer with innovation strategy. With a concern for high quality an analyzer with innovation strategy is a likely strategy for NCW Organization.

An organization with a prospector strategy is an organization that continually searches for market opportunities and regularly experiments with potential responses to emerging environmental trends. Thus, the organization is often the creator of change and uncertainty to which its competitors must respond. However, because of its strong concern for product and market innovation, a prospector usually is not completely efficient.

For a prospector strategy to be aggressive in product development or market opportunities exploitation, it requires a high capital investment. NCW Organization has numerous products. A prospector is constantly seeking new product opportunities to serve the existing and potentially new customers. With a concern for high quality a prospector strategy is a likely strategy for NCW Organization. With top management preferring a relatively low level of microinvolvement, the strategy is likely to be prospector.

THE CURRENT ORGANIZATIONAL CHARACTERISTICS

Based on your answers, the organization's complexity, formalization, and centralization have been calculated. This is the current organization. Later in this report, there will be recommendations for the organization.

The current organizational complexity is medium (cf 82).

The current horizontal differentiation is medium (cf 80).

The current vertical differentiation is low (cf 80).

The current spatial differentiation is high (cf 80).

The current centralization is medium (cf 81).

The current formalization is medium (cf 76).

The current organization has been categorized with respect to formalization, centralization, and complexity. The categorization is based on the input you gave and does not take missing information into account.

SITUATION MISFITS

A situation misfit is an unbalanced situation among the contingency factors of management style, size, environment, technology, climate, and strategy.

There are no situation misfits (cf 100).

No situational misfits encountered.

ORGANIZATIONAL CONSULTANT RECOMMENDATIONS

Based on your answers about the organization, its situation, and the conclusions with the greatest certainty factor from the analyses above Organizational Consultant has derived recommendations for the organization's configuration, complexity, formalization, and centralization. There are also recommendations for coordination and control, the appropriate media richness for communications, and incentives. More detailed recommendations for possible changes in the current organization are also provided.

ORGANIZATIONAL CONFIGURATIONS

The most likely configuration that best fits the situation has been estimated to be a divisional configuration (cf 69).

It could also be: a matrix (cf 62).

It could also be: an adhocracy (cf 60).

It is certainly not: a machine bureaucracy (cf -80).

A divisional organization is an organization with self-contained unit grouping into relatively autonomous units coordinated by a headquarters, (product, customer, or geographical grouping).
When the organization is large, the configuration can be a divisional configuration. Because the organization has many products, the configuration should be divisional. The divisionalization of NCW Organization may be based on products or product groups.

Because the technology is not fully divisible, care should be taken in recommending a divisional configuration.
A matrix structure is a structure that assigns specialists from functional departments to work on one or more interdisciplinary teams that are led by project leaders. Permanent product teams are also possible. A dual hierarchy manages the same activities and individuals at the same time.

When NCW Organization has many products or markets, a matrix configuration is a likely configuration. When NCW Organization's environment has neither low equivocality nor low complexity, the configuration should be matrix. When NCW Organization is large, the configuration can be a matrix configuration. An organization with a developmental climate could have a matrix configuration.

An adhocracy organization is normally an organization with high horizontal differentiation, low vertical differentiation, low formalization, decentralization, and great flexibility and responsiveness.
An adhocracy configuration is appropriate when neither the environmental equivocality of NCW Organization nor the environmental uncertainty is low. NCW Organization has many products or many markets which indicates that an adhocracy is an appropriate configuration. When the organization is also young, the conclusion that it should bean adhocracy is further strengthened. Since top management has a low preference for microinvolvement, the ad hoc configuration is feasible. However, the size of the organization is not very important for the choice of an adhocracy configuration.

When the organization is confronted with hostility, it cannot be a machine bureaucracy. A machine bureaucracy cannot act appropriately when unexpected events occur.

ORGANIZATIONAL CHARACTERISTICS

The recommended degree of organizational complexity is low (cf 55).

It, too, could be: medium (cf 54).

Not much is known about the environment since both the environmental uncertainty and the environmental equivocality of NCW Organization are high. In this situation, the organizational complexity should be low. This allows the organization to adapt quickly. When the environmental hostility of NCW Organization is high, organizational complexity should be low.

Large public organizations should have medium to high organizational complexity. NCW Organization has a technology that is somewhat routine, which implies that the organizational complexity should be medium. Because NCW Organization has an advanced information system, organizational complexity can be greater than it could otherwise. A developmental climate in the organization requires a medium level of complexity.

The recommended degree of horizontal differentiation is low (cf 55).

The recommended degree of vertical differentiation is low (cf 79).

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The recommended degree of formalization is low (cf 71).

Since the set of variables in the environment that will be important is not known and since it is not possible to predict what will happen, no efficient rules and procedures can be developed, which implies that NCW Organization's formalization should be low. When environmental hostility is high formalization should be low. Low formalization is consistent with top management having a low preference for microinvolvement. A developmental climate in the organization requires a low level of formalization.

The recommended degree of centralization is high (cf 50).

When there is a high capital requirement and the product innovation is medium, as is the case for NCW Organization, centralization should be rather high to obtain efficiency. When the environment is extremely hostile, top management must take prompt action and centralization must be high. Because NCW Organization has an advanced information system, centralization can be greater than it could otherwise.

NCW Organization's span of control should be moderate (cf 60).

Since NCW Organization has some technology routineness, it should have a moderate span of control.

NCW Organization should use media with high media richness (cf 85).

The information media that NCW Organization uses should provide a large amount of information (cf 85).

Incentives should be based on results (cf 85).

NCW Organization should use meetings as means for coordination and control (cf 86).

When the environment of NCW Organization has high equivocality, high uncertainty, and high complexity, coordination and control should be obtained through integrators and group meetings. The richness of the media should be high with a large amount of information. Incentives must be results based. Coordination within each division is very important. Coordination between (among) divisions is usually relegated to top management, which is also concerned about strategic direction and allocation of funds between (among) the divisions. Technology efficiencies can be obtained by sharing technology, information and new developments across divisions. Liaison managers and technology committees are possible coordination mechanisms. Conferences among technical professionals can be very effective. When the organization has a developmental climate, coordination should be obtained using planning, integrators and meetings. Incentives could be results based with an individual orientation. An organization with a

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developmental climate will likely have to process a large amount of information and will need information media with high richness.

ORGANIZATIONAL MISFITS

Organizational misfits compares the recommended organization with the current organization.

The following organizational misfits are present: (cf 100).

Current and prescribed complexity do not match.
Current and prescribed centralization do not match.
Current and prescribed formalization do not match.
Current and prescribed configuration do not match.

MORE DETAILED RECOMMENDATIONS

There are a number of more detailed recommendations (cf 100).

Top management may control the execution of decisions more actively.
You may consider decreasing the number of positions for which job descriptions are available.
You may give supervisors and middle managers fewer rules and procedures.
Managerial employees may be asked to pay less attention to written instructions and procedures.
The typical middle manager may be given less discretion over how work exceptions are to be handled.
You may consider fewer written job descriptions.

END

APPENDIX C: RESULTS FROM ORGANIZATIONAL CONSULTANT (EXECUTION PROCESS)

REPORT SUMMARY - NCW Organization

Time: 11:08:00, 11/24/98
Scenario: Execution

INPUT DATA SUMMARY

The description below summarizes and interprets your answers to the questions about your organization and its situation. It states your answers concerning the organization's current configuration, complexity, formalization, and centralization. Your responses to the various questions on the contingencies of age, size, technology, environment, management style, cultural climate and strategy factors are also given. The writeup below summarizes the input data for the analysis.

- NCW Organization has an adhocracy configuration (cf 75).
- NCW Organization has a moderate number of different jobs (cf 80).
- Of the employees at NCW Organization 51 to 75 % have an advanced degree or many years of special training (cf 80).
- NCW Organization has 1 or 2 vertical levels separating top management from the bottom level of the organization (cf 80).
- The mean number of vertical levels is 1 or 2 (cf 80).
- NCW Organization has 16 to 30 separate geographic locations (cf 80).
- NCW Organization's average distance of these separate units from the organization's headquarters is 101 to 500 miles (cf 100).
- 61 to 90 % of NCW Organization's total workforce is located at these separate units (cf 80).
- Job descriptions are available for all employees, including senior management (cf 100).
- Where written job descriptions exist, the employees are supervised moderately closely to ensure compliance with standards set in the job description (cf 80).
- The employees are allowed to deviate a moderate amount from the standards (cf 80).
- 81 to 100 % non-managerial employees are given written operating instructions or procedures for their job (cf 60).
- The written instructions or procedures given are followed to a great extent (cf 75).
- Supervisors and middle managers are to a little extent free from rules, procedures, and policies when they make decisions (cf 80).
- 21 to 40 % of all the rules and procedures that exist within the organization are in writing (cf 60).

- Top Management is in an undetermined way involved in gathering the information they will use in making decisions (cf 100).

- Top management participates in the interpretation of an undetermined percentage of the information input (cf 100).

- Top management directly controls 0 to 20 % of the decisions executed (cf 80).

- The typical middle manager has little discretion over establishing his or her budget (cf 80).

- The typical middle manager has little discretion over how his/her unit will be evaluated (cf 90).

- The typical middle manager has some discretion over the hiring and firing of personnel (cf 80).

- The typical middle manager has little discretion over personnel rewards - (ie, salary increases and promotions) (cf 90).

- The typical middle manager has some discretion over purchasing equipment and supplies (cf 80).

- The typical middle manager has little discretion over establishing a new project or program (cf 80).

- The typical middle manager has great discretion over how work exceptions are to be handled (cf 70).

- NCW Organization has 3000 employees (cf 80).

- NCW Organization's age is young (cf 90).

- NCW Organization's ownership status is public (cf 75).

- NCW Organization has many different products (cf 80).

- NCW Organization has some different markets (cf 80).

- NCW Organization has an undertermined level of international activity (cf 100).

- NCW Organization has an undetermined number of different products in the foreign markets (cf 100).

- NCW Organization's major activity is categorized as production (cf 60).

- NCW Organization has an undetermined production technology (cf 100).

- NCW Organization has a nonroutine technology (cf 90).

- NCW Organization's technology is somewhat divisible (cf 80).

- NCW Organization's technology dominance is average (cf 80).

- NCW Organization has either planned or already has an advanced information system (cf 100).

- NCW Organization's environment is complex (cf 100).

- The uncertainty of NCW Organization's environment is high (cf 100).

- The equivocality of the organization's environment is medium (cf 75).

- NCW Organization's environment is extremely hostile (cf 80).

- Top management prefers to make policy and general resource allocation decisions (cf 90).

- Top management primarily prefers to make long-term decisions (cf 80).

- Top management has a preference for very aggregate information when making decisions (cf 80).

- Top management has a preference for proactive actions (cf 80).
- Top management is risk neutral (cf 80).
- Top management has a preference for motivation through inspiration (cf 75).
- NCW Organization operates in an industry with a high capital requirement (cf 90).
- NCW Organization has a medium product innovation (cf 70).
- NCW Organization has a medium process innovation (cf 70).
- NCW Organization has a high concern for quality (cf 80).
- NCW Organization's price level is undetermined relative to its competitors (cf 100).
- The level of trust is high (cf 80).
- The level of conflict is medium (cf 80).
- The employee morale is high (cf 80).
- Rewards are given in a moderately equitably fashion (cf 80).
- The resistance to change is medium (cf 80).
- The leader credibility is high (cf 80).
- The level of scapegoating is low (cf 80).

THE SIZE

The size of the organization - large, medium, or small - is based upon the number of employees, adjusted for their level of education or technical skills.

Based on the answers you provided, it is most likely that your organization's size is large (cf 80).

Between 51 and 75 % of the people employed by NCW Organization have a high level of education. Adjustments are made to this effect. The adjusted number of employees is greater than 2,000 and NCW Organization is categorized as large.

THE CLIMATE

The organizational climate effect is the summary measure of people and behavior.

Based on the answers you provided, it is most likely that the organizational climate is a developmental climate (cf 76).

The developmental climate is characterized as a dynamic, entrepreneurial and creative place to work. People stick their necks out and take risks. The leaders are considered to be innovators and risk takers. The glue that holds organizations together is commitment to experimentation and innovation. The emphasis is on being on the leading edge. Readiness for change and meeting new challenges are important. The organization's long-term emphasis is on growth and acquiring new resources. Success means having unique and new products or services and being a product or service leader is important. The organization encourages individual initiative and freedom.

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When the organization has a high to medium level of trust it is likely that the organization has a developmental climate. Employees with a high morale is frequently one element of a developmental climate. Moderately to high equitable rewards in the organization drives the climate towards a developmental climate. Medium to high leader credibility characterizes an organization with a developmental climate. An organization with a medium level of scapegoating may have a developmental climate.

THE MANAGEMENT STYLE

The level of management's microinvolvement in decision making is the summary measure of management style. Leaders have a low preference for microinvolvement; managers have a high preference for microinvolvement.

Based on the answers you provided, it is most likely that your management profile has a low preference for microinvolvement (cf 80).

The management of NCW Organization has a preference for delegating decisions. This will lead toward a low preference for microinvolvement. Management has a long-term horizon when making decisions, which characterizes a preference for a low microinvolvement. Since the management has a preference for making decisions on the basis of very aggregate information a low preference for microinvolvement characterization is appropriate. The management of NCW Organization has a preference for taking actions when making decisions. This will lead toward a low preference for microinvolvement because meeting the problems before they arise allow you to work on the general level and not being consumed with the very detailed decisions that can best be made at lower level in the organization. Management has a preference for motivating people and not using control which will lead toward a low preference for microinvolvement.

THE STRATEGY

The organization's strategy is categorized as one of either prospector, analyzer with innovation, analyzer without innovation, defender, or reactor. These categories follow Miles and Snow's typology. Based on your answers, the organization has been assigned to a strategy category. This is a statement of the current strategy; it is not an analysis of what is the best or preferred strategy for the organization.

Based on the answers you provided, it is most likely that your organization's strategy is a prospector strategy (cf 76).

An organization with a prospector strategy is an organization that continually searches for market opportunities and regularly experiments with potential responses to emerging environmental trends. Thus, the organization is often the creator of change and

uncertainty to which its competitors must respond. However, because of its strong concern for product and market innovation, a prospector usually is not completely efficient.

For a prospector strategy to be aggressive in product development or market opportunities exploitation, it requires a high capital investment. A non-routine technology is likely to be costly for NCW Organization, and a prospector strategy of new product development where margins are likely to be high is very reasonable. NCW Organization has numerous products. A prospector is constantly seeking new product opportunities to serve the existing and potentially new customers. With a concern for high quality a prospector strategy is a likely strategy for NCW Organization. With top management preferring a relatively low level of microinvolvement, the strategy is likely to be prospector.

THE CURRENT ORGANIZATIONAL CHARACTERISTICS

Based on your answers, the organization's complexity, formalization, and centralization have been calculated. This is the current organization. Later in this report, there will be recommendations for the organization.

The current organizational complexity is medium (cf 82).

The current horizontal differentiation is medium (cf 80).

The current vertical differentiation is low (cf 80).

The current spatial differentiation is high (cf 80).

The current centralization is medium (cf 85).

The current formalization is high (cf 76).

The current organization has been categorized with respect to formalization, centralization, and complexity. The categorization is based on the input you gave and does not take missing information into account.

SITUATION MISFITS

A situation misfit is an unbalanced situation among the contingency factors of management style, size, environment, technology, climate, and strategy.

There are no situation misfits (cf 100).

No situational misfits encountered.

ORGANIZATIONAL CONSULTANT RECOMMENDATIONS

Based on your answers about the organization, its situation, and the conclusions with the greatest certainty factor from the analyses above Organizational Consultant has derived recommendations for the organization's configuration, complexity, formalization, and centralization. There are also recommendations for coordination and control, the appropriate media richness for communications, and incentives. More detailed recommendations for possible changes in the current organization are also provided.

ORGANIZATIONAL CONFIGURATIONS

The most likely configuration that best fits the situation has been estimated to be an adhocracy configuration (cf 73).

It could also be: a simple (cf 65).

It is certainly not: a functional (cf -87).

It is certainly not: a professional bureaucracy (cf -97).

It is certainly not: a machine bureaucracy (cf -99).

An adhocracy organization is normally an organization with high horizontal differentiation, low vertical differentiation, low formalization, decentralization, and great flexibility and responsiveness.
An adhocracy configuration is appropriate when neither the environmental equivocality of NCW Organization nor the environmental uncertainty is low. NCW Organization has many products or many markets which indicates that an adhocracy is an appropriate configuration. When the organization is also young, the conclusion that it should bean adhocracy is further strengthened. Since top management has a low preference for microinvolvement, the ad hoc configuration is feasible. However, the size of the organization is not very important for the choice of an adhocracy configuration. A prospector like NCW Organization should be configured as an ad hoc organization.

A simple organization has a flat hierarchy and a singular head for control and decision making.
The primary reason for recommending a simple configuration is that the organization has extreme environmental hostility. Extreme environmental hostility requires that the organization can respond consistently and rapid to unforeseen challenges. Therefore, it must have a simple configuration.
A prospector like NCW Organization can be configured as a simple organization.
The configuration cannot be a functional configuration when the technology is nonroutine.

Because the organization does not have a routine technology, it is not likely that a professional bureaucracy is an efficient organization.

Since the organization has a prospector strategy, it cannot have a configuration like a professional bureaucracy.

When the organization has a nonroutine technology, it is not likely that a machine bureaucracy is an efficient organization.

When the organization has a prospector strategy, it cannot be a machine bureaucracy! When the organization is confronted with hostility, it cannot be a machine bureaucracy. A machine bureaucracy cannot act appropriately when unexpected events occur.

ORGANIZATIONAL CHARACTERISTICS

The recommended degree of organizational complexity is medium (cf 54).

It, too, could be: high (cf 54).

It, too, could be: low (cf 51).

Large public organizations should have medium to high organizational complexity. The environmental uncertainty of NCW Organization is high, and the equivocality of NCW Organization's environment is medium. For this situation the organizational complexity should be medium. There is no need for an elaborate hierarchy or work specialization. Because NCW Organization has an advanced information system, organizational complexity can be greater than it could otherwise. A developmental climate in the organization requires a medium level of complexity.

NCW Organization has a prospector strategy. Then, the organizational complexity should be either low or high. NCW Organization has a nonroutine technology, which implies that the organizational complexity should be high. Top management of NCW Organization has a preference for a low level of microinvolvement, which allows for a higher organizational complexity. Because NCW Organization has an advanced information system, organizational complexity can be greater than it could otherwise. Since the size of NCW Organization is large and NCW Organization has a nonroutine technology, the complexity should be high - particularly the vertical differentiation.

NCW Organization has a prospector strategy. Then, the organizational complexity should be either low or high. When the environmental hostility of NCW Organization is high, organizational complexity should be low.

The recommended degree of horizontal differentiation is low (cf 51).

It, too, could be: high (cf 51).

The recommended degree of vertical differentiation is low (cf 59).

It, too, could be: high (cf 51).

The recommended degree of formalization is low (cf 77).

When the organization is in the manufacturing industry and it does not have a routine technology, its formalization should be higher than if it had been in the service industry. NCW Organization has a prospector strategy. A low formalization is required so that the organization can react quickly. Low formalization is also required because of the need for innovations. Organizations with nonroutine technology should have low formalization. When environmental hostility is high formalization should be low. Low formalization is consistent with top management having a low preference for microinvolvement. A developmental climate in the organization requires a low level of formalization.

The recommended degree of centralization is low (cf 48).

NCW Organization has a prospector strategy. A low centralization is required so that the organization can react and innovate quickly. Large organizations should have low centralization. Since NCW Organization operates in a complex environment and knows only some of the factors that affect the organization and when the values of the factors are relatively unstable, centralization should be low. Low centralization can be allowed when top management has no desire for microinvolvement. A developmental climate in the organization requires a medium to low level of centralization.

NCW Organization's span of control should be narrow (cf 58).

Since NCW Organization has a nonroutine technology, it should have a narrow span of control.

NCW Organization should use media with high media richness (cf 85).

The information media that NCW Organization uses should provide a large amount of information (cf 95).

Incentives should be based on results (cf 95).

NCW Organization should use professionalization as means for coordination and control (cf 100).

With a nonroutine technology NCW Organization should obtain coordination and control via group meetings. Media with high richness and large amount of information should be used. Incentives should be based on results. When NCW Organization's environment has

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medium equivocality, high uncertainty, and high complexity, coordination and control should be obtained through integrators and group meetings. The richness of the media used should be medium with a large amount of information to cope with the environmental complexity and uncertainty. Incentives must be results based. An open organizational climate and team spirit must be fostered. Information must be shared among all levels. Constructive conflict on 'what to do' will be usual. Individual tolerance of ambiguity and uncertainty will be necessary. Individual performance evaluation will be problematic and largely subjective. Mutual adjustments of 'give and take' will be the norm. Frequent informal meetings and temporary task forces will be the primary coordinating devices. When the organization has a developmental climate, coordination should be obtained using planning, integrators and meetings. Incentives could be results based with an individual orientation. An organization with a developmental climate will likely have to process a large amount of information and will need information media with high richness.

ORGANIZATIONAL MISFITS

Organizational misfits compares the recommended organization with the current organization.

The following organizational misfits are present: (cf 100).

Current and prescribed centralization do not match.
Current and prescribed complexity do not match.
Current and prescribed formalization do not match.

MORE DETAILED RECOMMENDATIONS

There are a number of more detailed recommendations (cf 100).

Middle managers may be given more discretion over evaluations.
The typical middle manager may be given more discretion over personnel rewards.
Middle managers may be given more discretion over establishing budgets.
The typical middle manager may be given more discretion over establishing a new program or project.
You may consider decreasing the number of positions for which job descriptions are available.
You may give supervisors and middle managers fewer rules and procedures.
Managerial employees may be asked to pay less attention to written instructions and procedures.
You may consider fewer written job descriptions.

END

LIST OF REFERENCES

Baligh, H.H., Burton, R.M., and Obel, B., "Organizational Consultant: Creating a Useable Theory for Organizational Design," *Management Science*, v. 42, December 1996.

Bhargave, S., and Sinha, B., "Prediction of Organizational Effectiveness as a Function of Type of Organizational Structure," *The Journal of Social Psychology*, v. 132 (2), pp. 223-231, April 1992.

Bolman, L.G., and Deal, T.E., *Reframing Organizations: Artistry, Choice, and Leadership*, 1st ed., Jossey-Bass, 1991.

Bowditch, J.L., and Buono, A.F., *A Primer on Organizational Behavior*, 4th ed, Wiley, 1997.

Burton, R.M., and Obel B., Strategic Organizational Diagnosis and Design: Developing Theory for Application, Kluwer Academic Publisher, 1995.

Burton, R.M., and Obel B., Strategic Organizational Diagnosis and Design: Developing Theory for Application, Kluwer Academic Publisher, 1998.

Cebrowski, A.K., and Garstka, J.J., "Network-Centric Warfare Its Origin and Future," *Proceedings*, January 1998.

Department of the Navy, Naval Doctrine Publication (NDP) 6, *Naval Command and Control*, 19 May 1995.

FEMIS, Federal Emergency Management Information System Overview, Pacific Northwest National Laboratory, 1995.

Fukuyama, F. and Shulsky, A.N., *The Virtual Corporation and Army Organization*, 1st ed, RAND, 1997.

Huber, A.F., and others, *The Virtual Combat Air Staff: the Promise of Information Technologies*, 1st ed, RAND, 1996.

Johnson, J.J., "Anytime, Anywhere: A Navy for the 21st Century," *Proceedings*, November 1997.

Johnson, R.E., "Information Warfare: Impacts on Command and Control Decision-Making," Strategy Research Project, U.S. Army War College, Carlisle Barracks, PA, 15 April 1996.

Joint Publication 1, *Joint Warfare of the U.S. Armed Forces*, 11 November 1991.

Joint Publication 1-02, *Dictionary of Terms*, 1995.

Jones, C.R., "The Organizational Design Module," Lecture notes for CM 3111, Naval Postgraduate School, Monterey, California, Academic Year 1985-1986.

Kemple, W.G., "Adaptive Architectures for Command and Control (A2C2)," *NPS Research*, p. 5, February 1998.

Klein, G., *Sources of Power: How People Make Decisions*, MIT Press, 1998.

Klein, G.K., and Miller, T., "Distributed Planning Teams," Klein Associates Inc., Fairborn, Ohio, 1997.

Krulisch, A., "Speed of Command," Chief of Naval Operations Strategic Studies Group, Newport, R. I., January 1998.

Miles, R.E., and Snow, C.C., *Organizational Strategy, Structure and Process*, McGraw-Hill, 1978.

Mintzberg, H., *Structures in Fives*, Prentice-Hall, 1983.

N816, Draft of "Network Centric Warfare: A Naval Operational Concept," 19 May 1998.

Office of the Secretary of Defense/Net Assessment, "Trends in Future Warfare Concept Paper," 18 December 1997.

ORGCON v7.0, computer program in: Burton, R.M., and Obel B., Strategic Organizational Diagnosis and Design: Developing Theory for Application, Kluwer Academic Publisher, 1998.

Roman, G.A., "The Command or Control Dilemma: When Technology and Organizational Orientation Collide," Institute for National Strategic Studies, http://www.ndu.edu/ndu/inss/books/essa/essaccdw.html, 1996.

Serfaty, D., "Adaptation in Command Teams: An Overview," Aptima Inc., undated.

Stein, F.P., "Network Centric Warfare: The Face of Battle in the 21st Century," 8 July 1998a.

Stein, F.P., "Observations on the Emergence of Network Centric Warfare," paper presented at the 1998 Command and Control Research and Technology Symposium, Naval Postgraduate School, Monterey, California, 29 June 1998b.

Stein, F.P. and Garstka, J.J., "The Emerging Joint Strategy for Information Superiority," 1998c.

SSG XVII Decision Concept Generation Team, "Decisions 2030," Stategic Studies Group, Newport, R.I., August 1998.

U.S. Marine Corps, Command and Control (MCDP 6), Government Printing Office, Washington, D.C., 1996.

U.S. Marine Corps, Warfighting (FMFM 1), Government Printing Office, Washington, D.C.

Weick, K.E., *The Executive Mind*, Jossey-Bass, 1983.

Welch, T.J., "Some Perspectives on the Revolution in Military Affairs," Office of Net Assessment, Office of the Secretary of Defense, 1996.

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